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# ACCIDENTS

IN THE

STATE OF CALIFORNIA

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ACCIDENTS IN THEIR MEDICO-LEGAL  
ASPECT

PLATE I.



X-RAY PHOTOGRAPH OF DAVIS (ROTHWELL *v.* DAVIS), TAKEN IN 1908,  
FROM THE PALM.

P marks the pyramid of bone developed after an injury; *s.b.* are merely sesamoid bones in the tendons, etc., and have no relation to the injury. For full explanation see Plate II.

*Frontispiece.*

## PLATE II.



LIFE-SIZE X-RAY PHOTOGRAPH OF THE SAME BONE, AS SHOWN IN PLATE I.,  
TAKEN FROM THE BACK, ABOUT EIGHTEEN MONTHS AFTER THE INJURY.

In February, 1901, Davis, a workman, injured his hand, a steel cutter striking his second metacarpal bone, and in consequence a pyramid of bone developed at the site of the wound (Plate I., P.). From that date till May, 1909, he refused to return to his old work, saying the handle of his hammer pressed upon the injured spot and caused him pain. Several operations were suggested to him to cure the pain, in particular one to remove this pyramid of bone. He refused, basing his refusal, in April, 1903, on the advice of Dr. Floyd, his own doctor, who, as quoted by Cozens-Hardy, M.R., in *Warncken v. Richard Morland*, 1909, 1 K.B., at p. 187, said that it was an operation likely to involve risk of life. As the man was acting on skilled advice, that of a qualified medical man, the Court of Appeal decided the refusal was "reasonable," and Davis was in May, 1909, still drawing some compensation as being partially incapacitated. (See Operation, p. 28, and Case Guide: Bones, p. 889.)

*To face Plate I.*



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# ACCIDENTS

IN THEIR

## MEDICO-LEGAL ASPECT

BY  
LEADING MEDICAL AND SURGICAL AUTHORITIES

EDITED BY

DOUGLAS KNOCKER

BARRISTER-AT-LAW; EDITOR OF BUTTERWORTH'S "WORKMEN'S COMPENSATION  
QUARTERLY REPORTS," AND JOINT EDITOR WITH HIS HONOUR  
JUDGE RUEGG, K.C., OF BUTTERWORTH'S "WORKMEN'S  
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## LIST OF CONTRIBUTORS

- BARNARD, HAROLD LESLIE (THE LATE), M.S., M.B. Lond., F.R.C.S.,  
Assistant-Surgeon to the London Hospital. **Rupture.**
- BARWELL, HAROLD E., M.B. Lond., F.R.C.S. Eng., Surgeon for Diseases  
of the Throat and Nose, St. George's Hospital; Surgeon in Charge of  
the Throat and Ear Department, Hampstead General Hospital.  
**Nose, Throat, and Ear.**
- BATTEN, FREDERICK E., M.D., F.R.C.P., Physician to the Hospital for  
Sick Children, Great Ormond Street; Physician to the Out-Patients,  
National Hospital for the Paralyzed and Epileptic, Queen Square.  
**Brain, Nerves, and Spinal Cord.**
- BEDDARD, A. P., M.A., M.D., F.R.C.P., Assistant-Physician and Lecturer  
on Materia Medica, Guy's Hospital Medical School. **Expert Evidence.**
- BENNETT, NORMAN G., M.B., B.C. Cantab., L.D.S. Eng., Dental Surgeon  
to St. George's Hospital and to the Royal Dental Hospital of London.  
**Teeth.**
- BERRY, JAMES, B.S., F.R.C.S., Senior Surgeon to the Royal Free Hospital  
and to the Mount Vernon Hospital for Diseases of the Chest.  
**Heart, Lungs, and Trachea.**
- BISS, HUBERT E. J. (THE LATE), M.A., M.D. Camb., D.P.H., Medical  
Examiner and Referee to the Sun Insurance, Legal and General, and  
other Insurance Companies. **Neurasthenia (Traumatic).**
- BLAND-SUTTON, J., F.R.C.S. Eng., Surgeon to the Middlesex Hospital;  
Senior Surgeon to the Chelsea Hospital for Women; formerly Hunterian  
Professor, Royal College of Surgeons. **Breast.**
- BLUMFELD, J., F.R.C.S., Senior Anæsthetist to St. George's Hospital,  
London; Hon. Anæsthetist to St. Mary's Hospital and to the Hospital of  
St. John and Elizabeth. **Anæsthetics.**
- BOYCOTT, A. E., M.A., M.D., Lecturer on Pathology, Guy's Hospital.  
**Ankylostomiasis.**
- BUCKNALL, RUPERT (THE LATE), M.D., M.S. Lond., Surgeon to University  
College Hospital; Lecturer on Surgery, University College Hospital  
Medical School. **Wounds.**
- CARLING, E. ROCK, B.S. Lond., F.R.C.S. Eng., Assistant-Surgeon to  
Westminster Hospital; Surgeon to the Seamen's Hospital, Greenwich.  
**Bursæ, Fasciæ, Joints, Muscles, Tendons.**

- CHEATLE, G. LENTHAL, C.B., F.R.C.S., Surgeon to King's College Hospital ;  
Teacher of Practical Surgery in the King's College Hospital Medical  
School ; Surgeon to the Italian Hospital. **Infection.**
- COLLIE, SIR R. J., M.D., J.P., Home Office Medical Referee under Workmen's  
Compensation Act, Medical Officer to the Solicitors', Tramway, and other  
Departments of the London County Council ; Chief Medical Officer to the  
Metropolitan Water Board and the London Fire Brigade. **Malingering.**
- CORNER, EDRED M., M.C., F.R.C.S., Surgeon to the Children's Hospital,  
Great Ormond Street ; Surgeon to the Surgical Infectious Wards and to  
Out-Patients, St. Thomas Hospital. **Gangrene, Glanders, Rabies, Tetanus.**
- DUNCAN, ANDREW, LIEUTENANT-COLONEL, I.M.S. (retired), M.D., B.S.  
Lond. F.R.C.P., F.R.C.S., Lecturer on Tropical Diseases, London School  
of Tropical Medicine and Westminster Hospital Medical School ; Fellow  
of King's College, London. **Tropics.**
- EASON, HERBERT, M.D., M.S., Senior Ophthalmic Surgeon, Guy's Hospital.  
**Eye.**
- EURICH, F. W., M.D., Honorary Physician, Royal Infirmary, Bradford ;  
Bacteriologist to the City of Bradford and to the Anthrax Investigation  
Board for Bradford and District. **Anthrax.**
- HOBDAY, FREDERICK, F.R.C.V.S., F.R.S.E., late Professor in the Royal  
Veterinary College, and late Examiner to the Royal College of Veterinary  
Surgeons. **Glanders, Rabies.**
- HOWELL, C. M. HINDS., M.D. Oxon., M.R.C.P., Physician to Great Northern  
Central Hospital ; Registrar, with Charge of Electrical Department, of the  
National Hospital for Paralysis and Epilepsy. **Electrical Injuries.**
- HYSLOP, THEO. B., M.D., C.M., M.R.C.P. Edin., F.R.S. Edin., late Resi-  
dent Physician, Bethlehem Hospital ; Lecturer on Mental Physiology, St.  
Mary's Hospital School ; Lecturer on Mental Disease, London School of  
Medicine for Women ; Examiner, Royal Army Medical Service. **Insanity.**
- KELLOCK, THOMAS H., M.A., M.D. Cantab., F.R.C.S., Surgeon to the  
Hospital for Sick Children, Great Ormond Street ; Surgeon to the Out-  
Patients, Middlesex Hospital. **Children.**
- KNOCKER, DOUGLAS, Barrister-at-Law ; Editor Butterworth's "Workmen's  
Compensation Quarterly Reports," and Joint Editor with His Honour  
Judge Ruëgg, K.C., of Butterworth's "Workmen's Compensation Cases."  
**The Legal Aspect of Accident, and Case Guide.**
- LISTER, THOMAS D., M.D., B.S. Lond., M.R.C.P. Lond., F.R.C.S. Eng.,  
Physician to the Mount Vernon Hospital for Diseases of the Chest, and  
to the Royal Waterloo Hospital. **Heart, Lungs, Trachea.**
- MACLEOD, JOHN H., M.A., M.D., M.R.C.P., Physician for Diseases of the  
Skin, Charing Cross Hospital and Victoria Hospital for Children ; Lecturer  
on Skin Diseases, London School of Tropical Medicine and Charing Cross  
Hospital Medical School ; Editor of *British Journal of Dermatology*. **Skin.**
- PARDOE, JOHN, M.B., F.R.C.S., Assistant-Surgeon to St. Peter's Hospital for  
Stone and Genito-Urinary Diseases, and Assistant-Surgeon to the West  
London Hospital **Bladder, Genital Organs—Male.**

- RAWLING, LOUIS BATHE, M.B., B.C. Cantab., F.R.C.S., Assistant-Surgeon and Demonstrator of Operative and Practical Surgery to St. Bartholomew's Hospital and Medical School. **Bloodvessels, Lymphatics.**
- SARGENT, PERCY, M.B., B.C., F.R.C.S., Assistant-Surgeon to St. Thomas's Hospital and to the National Hospital for the Paralyzed and Epileptic, Queen Square. **Bones, Brain, Nerves, Spinal Cord.**
- SHERREN, JAMES, F.R.C.S., Surgeon to the London Hospital; Surgeon to the Poplar Hospital for Accidents; late Erasmus Wilson Lecturer, Royal College of Surgeons. **Abdomen, Appendix, Intestines, Liver, Œsophagus, Pancreas, Peritoneum, Rupture, Spleen, Stomach, Suprarenal Glands.**
- SMITH, F. J., F.R.C.P., Lond., F.R.C.S. Eng., Lecturer on Medical Jurisprudence at the London Hospital; Medical Referee to the Home Office; Editor of *Taylor's Medical Jurisprudence*. **Poisons.**
- SOMERVILLE, DAVID, B.A., M.D., D.P.H., M.R.C.P., F.C.S., Lecturer in Public Health, King's College, London. **Preservatives and Adulterants in Food**
- STEVENS, THOMAS G., M.D., B.S. Lond., F.R.C.S. Eng., M.R.C.P. Lond. Physician to Out-Patients, Queen Charlotte's Lying-in Hospital; Physician to the Hospital for Women, Soho Square; Obstetric Tutor, St. Mary's Hospital, Paddington. **Genital Organs—Female.**
- THOMSON, H. CAMPBELL, M.D. Lond., F.R.C.P., Physician to Out-Patients at the Middlesex Hospital; Physician to the Hospital for Epilepsy and Paralysis, Maida Vale; Physician to the Bolingbroke Hospital; Medical Referee, Workmen's Compensation Act. **Neurasthenia (Traumatic).**
- TUBBY, A. H., M.S. Lond., F.R.C.S. Eng., Surgeon to Westminster Hospital and to the Royal National Orthopædic Hospital; Consulting Surgeon to the Evelina Hospital for Children. **Bursæ, Fasciæ, Joints, Muscles, Tendons.**
- WALKER, J. W. THOMPSON, F.R.C.S., Surgeon in Charge of Out-Patients at the North-West London Hospital and Hampstead General Hospital; Assistant Surgeon at St. Peter's Hospital for Stone, etc. **Kidney.**
- WETHERED, FRANK J., M.D., F.R.C.P., Physician, with Care of Out-Patients, to the Middlesex Hospital, and Lecturer on Medical Jurisprudence, Middlesex Hospital Medical School; Physician to the Hospital for Consumption and Diseases of the Chest, Brompton. **Alcohol.**
- WILLCOX, W. H., M.D., B.Sc. Lond., D.P.H., F.I.C., Lecturer on Public Health and Forensic Medicine to St. Mary's Hospital, London, W.; Physician to Out-Patients, St. Mary's Hospital; Senior Scientific Analyst to the Home Office. **Ptomaine-Poisoning.**



## PREFACE

WHEN bodily injury is caused by an accident, and an attempt is made to hold another responsible for it, the case has two main aspects, the one legal, the other medical. Owing to the enormous number of cases decided in the Courts under the law of negligence and the Workmen's Compensation Act, the law has been so fully developed that, except in rare cases, the legal position of an injured man is clear, provided the necessary facts can be proved. A simple demonstration of this is found in the fact that companies insuring against accidents do not fight, on legal points, one per cent. of the cases in which a claim is made. All that is required to ascertain the legal position of an injured man is to refer to the law and the decided cases, from which it can usually be determined whether the defendant is liable or not.

In considering the medical aspect of such a case, all this precision vanishes. Instead of the certainty of developed law, we have uncertain facts and opinions of a kind most difficult to test, and it is impossible to foretell what deductions will be drawn from these facts and from the opinions expressed by these witnesses. There is no "Law," no authoritative Law Reports and Digest of Reported Cases, to which we may look to see the result of the medical facts proved. In each fresh case, all that can be obtained is the evidence of the doctors on each side. This evidence, which is frequently conflicting, is of two classes. The first deals with the injurious effects produced on the human body by an accident. This is really evidence of Fact. The second class deals with the untoward consequences which may or may not flow from these injuries. This is not

really evidence, but, as is said elsewhere, is skilled prophecy. From this highly controversial material, the tribunal, probably untrained in medicine, has to decide the extent of the plaintiff's injuries, and of the consequent liability of the defendant. When a final judgment is given on this most uncertain ground, the aggrieved litigant cannot possibly further test his point, for there is no Medical Court of Appeal to correct the mistakes of the Court below.

In any important case where the heads of the medical profession are called as witnesses, no doubt the Court has before it the honest opinions of the highest authorities, and therefore has ground upon which to base its decision; but still the Judge or jury have to decide as best they can between the conflicting opinion of experts. Under these circumstances, a verdict has before now been given upon the evidence of a medical witness, who has sworn to the existence of conditions, in the body of the injured man, which would be rejected as impossible by a jury of doctors. Such untrustworthy evidence may be given by a man who makes an honest error in sheer ignorance, or by one who dishonestly makes a guess instead of frankly confessing to his lack of knowledge. The difficulty does not end here, for, in spite of the straightforward manner in which medical evidence is usually given, we must not blind our eyes to the fact that, especially in the large towns, there is a class—no doubt a very small one—that lives by giving expert evidence, and, often with extreme ingenuity and plausibility, frequently commits deliberate perjury in the witness-box—perjury made worse by the fact that it is uttered by an educated and professional man, who knows he cannot be prosecuted, as he swears he is only expressing his opinion.

It is at times instructive to notice the difference between the evidence of ignorant or dishonest witnesses when a medical assessor is sitting, and in the absence of this restraint: before the assessor, Ignorance hesitates to guess or Perjury to lie.

That there is only too much truth in the above drastic statement is evidenced by the recent change in the views of the County Court Judges with regard to the medical assessor under the Workmen's Compensation Act.

Only some three years ago, County Court Judges in most cases listened somewhat unwillingly to the suggestion of either party that they should summon an assessor, and usually refused to do so.

Now, however, especially in the Metropolis, assessors are summoned to sit in nearly all cases involving medical points of any importance, and many of the Judges have publicly expressed their appreciation of the great value to them of this expert assistance. Some few Judges even summon an assessor without waiting for the application of the parties.

In the absence of a medical assessor—for he cannot be summoned outside the Workmen's Compensation Act—in addition to the above difficulties, the Court is further hampered in coming to a just conclusion, because it is not provided with the help it usually derives from a severe cross-examination. For counsel are necessarily but amateurs in anatomy and surgery, and therefore find it difficult to expose the ignorance or untruthfulness of the adverse expert witness, and even to appreciate and elucidate the full meaning of the evidence of their own doctors.

These circumstances have been deemed sufficient to justify the publication of this book, which seeks to establish some sort of standard by which we may test the accuracy of medical evidence in accident cases.

To claim that it is the last word on the various subjects treated here, or contains all that could possibly come before the Courts, would be absurd; but it is a dispassionate attempt to give some authoritative standard to which lawyers may refer if differences of opinion are expressed by medical witnesses.

The book is divided into three sections—the Legal Part, the Medical Part, and the Case Guide. The index covers all three parts.

The legal part is not intended to be exhaustive, nor to compete in any way with the many excellent textbooks which cover all the branches of the law germane to this work; all that is claimed for it is that it gives to medical men a short statement of the law on matters of interest to them. At the same time, the cases referred to may give some help to lawyers by leading

them at once to the line of cases they desire for any point in the law of accidents, etc.

The medical part of the book has been written mainly to assist the lawyer to understand the consequences of an accident to the part of the body alleged to have been injured, and to help him to follow the medical witnesses when they deviate slightly from the beaten track. It need hardly be said that it is not intended to instruct the medical expert in the details of his profession, but it is hoped that he, too, will derive benefit by learning the special points to which counsel is likely to ask him to turn his mind. It is not, therefore, a treatise on injury and cure ; it contains the essentials which are required in Court rather than in the consulting-room ; medical treatment is entirely ignored, and diagnosis is only lightly touched upon, as being far too difficult a subject to explain to a reader who has not a substantial groundwork of medical knowledge to guide him.

The following are the features the book presents to the reader. It is written, as far as possible, in simple English ; for though there are numerous well-known works on anatomy and surgery written for the medical profession, they are couched in technical terms, well known to the medical student, but hard to the layman's understanding. In this book such terms are, as far as possible, either avoided, paraphrased, or explained, and a list of the technical expressions likely to be used by a witness is put at the head of each article, with explanations attached and accent marks on the vowels.

When an accident has occurred, there are certain points which must be dealt with, many of which, though essential to the conduct of an accident case, are not touched upon in the leading medical and surgical textbooks.

The medical part of this book has been planned by the editor with these points in view. He therefore gave to each of the contributors a similar schedule, by following which every title has been classified under identical and uniform headings. By reference to these headings the following questions can in each case be answered :

What are the immediate consequences of the accident ?



What chance is there of disease supervening as a remote consequence of the injury?

Was there any disease existing before the accident and aggravating its effects?

Within what time will the man be physically cured, and when will he be fit to return to his former work, or to undertake some other employment?

Is there any need for an operation, and, if so, is it such an operation as a reasonable man would elect to undergo?

Is there any likelihood of a recurrence of the consequences of the injury?

There is one subject here that is hardly touched upon at all, and that is the "personal equation," or "idiosyncrasy," of the injured person. A great deal about idiosyncrasy is dragged into the witness-box in some cases, especially those of traumatic neurasthenia. The reason a medical witness often refers to idiosyncrasy is to account for a trivial accident apparently producing consequences disproportionate to the amount of injury inflicted. It is true that there is a difference in idiosyncratic susceptibility between one man and another, but in most cases this is so slight as to be negligible in considering the effects of an accident. "I am not as other men" is more often said by the patient than thought by the doctor. After hearing many independent experts on this subject, the editor has no hesitation in saying that in hospital treatment the difference between man and man is almost ignored.

The writers of the various articles were all chosen as being men eminent in the medical world; they mainly are or have been teachers at the great schools of medicine, and examiners to confer qualifications upon future doctors. Even more, they are the consultants to whom their former pupils turn for help in cases of difficulty, when they find that the maladies of their patients are beyond their knowledge.

The exact position and experience of each writer will be seen at a glance at the head of each article. As far as possible when the part of the body dealt with is one in which doctors have specialized, a specialist who has made a life study of that particular subject has been asked to write the article.

The third section of the book is the Case Guide, in which is given a short epitome of nearly every case referred to in the legal section, with a number of other cases of personal injury.

The object of this collection is threefold :

1. To afford lawyers numerous instances of cases where medical points have arisen and been thrashed out, in order to assist them in advising upon or conducting similar cases.
2. To give, as far as possible, to all engaged in litigation some idea of the amount of damages which will probably be recovered.
3. To assist doctors in estimating the probable duration of incapacity after injury.

The index covers all three parts of the work, and follows the ordinary arrangement of an index, with one unusual, and it is hoped useful, feature : under the title of each section is grouped an independent subindex, forming in itself a complete index to every passage in the book dealing with the subject of the section.

The original illustrations have been most carefully drawn by Mr. Bluett, of St. Thomas's Hospital, who took infinite care, trouble, and interest, in preparing them. The great points sought after in these are clearness and simplicity ; only the essential features of the injury are shown, the view not being obscured by unnecessary anatomical details.

Mr. Carless most kindly lent the numerous illustrations that are taken from Rose and Carless's well-known "Manual of Surgery," and it is owing to Mr. Buchanan's courtesy that we have been able to use a number of drawings from his "Manual of Anatomy." We are also indebted to Mr. McAdam Eccles for two illustrations from his book on "Hernia," and to Mr. E. Spurell for two from his "Elementary Physiology."

In addition the editor owes a warm debt of thanks to the various writers of this book for their attention to the numerous alterations, revisions, and suggestions, which they allowed him to make in their articles ; they have loyally carried out the scheme which he planned.

The editor has to express his great indebtedness to His Honour Judge Emden and to His Honour Judge Willis, K.C., for their kind suggestions.

It had been the intention of Mr. R. F. Colam to write the legal part of the work jointly with the editor (who had been his pupil); pressure of other work unfortunately prevented him from carrying this out, but he gave much valuable advice in connection with the work.

The editor is most grateful for the help given to him by his barrister friends, Ernest Jones Williams, H. C. Harbord, W. F. L. Braidwood, K. Francis, S. S. Abrahams, and D. Nowell Pritt, in correcting proofs, making valuable suggestions, and helping generally in the preparation of the work, and, as to three of the articles, for very thorough criticism from G. C. Kingsbury.

A great loss was sustained by the medical world during the course of the writing of this book by the unexpected death of the editor's friend, Harold Barnard, F.R.C.S., etc., Surgeon to the London Hospital. He had firmly established his position as a brilliant surgeon, and showed promise of rising to the top of his profession. He had only begun the articles on the Abdomen, since so ably written by James Sherren; but as a large part on Hernia was already written, this material was used, and the article completed by Mr. Sherren.

The editor also regretfully records the death of another valued friend in Dr. Hubert Biss. He had just finished the article on Traumatic Neurasthenia, which he was writing in collaboration with Dr. Campbell Thompson, when he began to suffer from symptoms of severe gastric trouble, from which he never recovered. All recognized in him a man of high personal quality, of most kindly consideration to all with whom he came in contact, and a thoroughly capable physician. He had been for some years the Assistant Editor of *The Medical Press and Circular*.

Above all, the editor wishes expressly to mention the great courtesy and forbearance shown to him by his publishers, Messrs. Baillière, Tindall and Cox.

They were most patient in enduring the serious, though inevitable delay, in the preparation of the work; they never murmured at the numerous small alterations in the text; and they voluntarily departed from their contract in order to make

allowance to the editor for certain of the expenses incurred by him in preparation.

Plates I. and II. are published through the courtesy of Messrs. Gradwell, Abercromby and Co., of Liverpool, by whom they were kindly supplied.

DOUGLAS KNOCKER.

THE TEMPLE,  
*October, 1910.*

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**PART I**  
**MEDICO-LEGAL ASPECT OF ACCIDENTS**



# MEDICO-LEGAL ASPECT OF ACCIDENTS

BY DOUGLAS KNOCKER

Editor of Butterworth's "Workmen's Compensation Quarterly Reports,"  
and Joint Editor with His Honour Judge Ruegg, K.C., of  
Butterworth's "Workmen's Compensation Cases."

## ACCIDENT AND ACCIDENTAL INJURIES.

THE word "accident" is used here in its widest sense, for, in speaking of an accident as a cause of personal injury, one includes "any mishap or untoward event which is not expected or designed," whether it be caused by the negligence of another person or not.

This would therefore include injuries caused by negligence, but the distinction between actions for personal injuries caused by negligence and actions brought for injuries caused by breach of contract is not always easy to maintain. The legal principles are distinct, but the facts are not always so clear, and a personal injury may give rise to an action against the same person for damages for breach of contract or for negligence; we therefore here extend the term to include personal injuries due to breach of contract.

Even in popular language, in some instances, the term "accident" is used when the action is for damages for breach of contract, as, for example, with a carrier by rail, the consequences of which are always called "railway accidents."

An accident in this sense may produce litigation on any one of four grounds:

(1) An insurance policy; (2) Negligence (under which we include assault, etc., but exclude contract); (3) Breach of contract; (4) The Workmen's Compensation Act, 1906.

### I. An Insurance Policy.

In these cases, whether the event upon which proceedings have been instituted is held to be an accident or not depends, to a great extent, upon the construction of the words used in the particular policy. Many cases illustrating this will be found in the Case Guide at the end of this book; but a full consideration of them and the fine distinctions that have been drawn between them is outside the scope of this work. The subject is further discussed below, under Consequences of Accident, etc. (p. 13).

### II. Negligence.

Here the ground of the action is not accident, but the negligence of the defendant or of some person for whom he is responsible. It is

seldom, if ever, of any consequence, from the plaintiff's point of view, to consider whether the event in respect of which proceedings are taken is or is not an accident, inasmuch as the issue is whether the defendant has or has not been negligent. In fact, "inevitable accident" may be a good defence.

"He is negligent or careless who does that which a reasonable man would not do, or who neglects to do that which a reasonable man would do" (per Alderson, B., in *Blyth v. Birmingham Waterworks Company*).<sup>4</sup> If in consequence of such behaviour another party is injured, then that party may have a right of action. Negligent acts are usually fairly obvious, but negligent omissions are not always so clear.

Baron Alderson's is the usual definition of negligence, but it is quite wide enough to include an intentional assault, which is an act no reasonable man would commit. In fact, some writers hold that the ground of action for all cases of personal injuries is not negligence, but assault or trespass against the person. It is clear from *Scott v. Shepherd*,<sup>34</sup> which was a case of an intentional act, that such an action will lie though proof of negligence is not offered. A similar theory is applicable to the principles underlying the decisions in cases based on *Rylands v. Fletcher*.<sup>33</sup> He who concentrates the forces of Nature does so at his peril, and if they escape he may be held liable for the damage done by them. Proof of damage is *prima facie* a cause of action after such escape, proof of negligence being unnecessary, as in assault. (It might be possible to class these cases under the head of negligent omissions to take care to prevent escape, but that is not the true ground of the judgments.) The onus is not, as in ordinary cases of negligence, on the plaintiff to prove the negligence of the defendant, but is on the defendant to establish some defence, such as statutory powers, to do the act complained of\* (*National Telephone Company v. Baker*<sup>28</sup>; *Vaughan v. Taff Vale Railway*<sup>41</sup>), or those circumstances mentioned as defences in the judgment of Blackburn, J., below; and see *Nichols v. Marsland*<sup>20</sup>; *Box v. Jubb*<sup>7</sup>; *Carstairs v. Taylor*<sup>10</sup>; *Madras Railway v. Zemindar of Carvatenagaram*.<sup>25</sup>

BLACKBURN, J., in *Rylands v. Fletcher*, said :

"The person who, for his own purposes, brings on his land, and collects and keeps there, anything likely to do mischief if it escapes, must keep it at his peril, and if he does not do so is *prima facie* answerable for all the damage which is the natural consequence of its escape. He can excuse himself by showing that the escape was owing to the plaintiff's default, or perhaps that the escape was the consequence of *vis major*, or the act of God; but as nothing of this sort exists here, it is unnecessary to inquire what excuse would be sufficient. . . . But for his act in bringing it there, no mischief could have accrued, and it seems but just that he should at his peril keep it there so that no mischief may accrue, or answer for the natural and anticipated consequences. And upon authority, this we think is established to be the law, whether the things so brought be beasts, or water, or filth, or stench."

\* But if the statutory power be negligently exercised, the defendant will be liable (*Batcheller v. Tunbridge Wells Gas Company*<sup>3</sup>; *Atherton v. London and North-Western Railway*<sup>2</sup>).

It would seem that the basis of the law of negligence is that everyone is taken to intend the natural and probable consequences of his acts, but that, where it is obvious that there is no intention to injure, this has to be rebutted by proving negligence. If this is so we have a regular gradient: (1) Assault, where the defendant is taken to have intended what he did (*Scott v. Shepherd*<sup>34</sup>), and the burden is on him to excuse himself from the consequences of his acts—*e.g.*, on the grounds of self-defence. (2) The principle of the judgment in *Rylands v. Fletcher*,<sup>33</sup> where the collection of "anything likely to do mischief" is done at the peril of the collector, who is considered to know that he is exposing his neighbours to grave risks; negligence is immaterial (for examples, see *Consequences of Accident*, p. 18). (3) Where the circumstances under which an accident happens create a presumption of negligence—*res ipsa loquitur*—which the defendant must disprove if he can (*Byrne v. Boadle*<sup>9</sup>; *Kearney v. London, Brighton and South Coast Railway*<sup>23</sup>). (4) Ordinary negligence cases, where there is no obvious intent to do harm, and so the person causing it escapes liability, unless he is affirmatively shown to have been negligent or careless.

The various defences to ordinary acts of negligence, the fourth class, are too numerous to recite here, and the regular textbooks of law must be consulted for them; but certain of them, which might have a medico-legal basis, are illustrated at the end of this section, p. 8. The consequences of personal injuries, whether fatal or not, are dealt with in the next section, *Consequences of Accident*, where numerous cases of each class are quoted.

### III. Breach of Contract.

Breach of contract, whether express or implied, oral or written, may give rise to an action for damages for personal injuries.

The effects of breach of a contract by one party thereto may be either personal injury, disease, or death, of the other, or of a third party whose injury causes damage to one of the contracting parties. For example, if a man purchase food under a contract, with an implied condition as to its fitness, and it makes him ill, he has a right of action for damages; but if, as a master of a house, he contracts with a tradesman to supply him with sound food for the use of his household, and the food in question is unsound, so that a wife or servant falls ill, and in consequence of that illness the master is deprived of their services, the breach of contract gives him a right of action for damages, the measure of which is the loss to which he has been put by the illness (*Frost v. The Aylesbury Dairy Company*<sup>17</sup>).

**Express Contracts.**—If there be any express contract, guarantee, or warranty, the exact terms of it must be carried out. The defendant cannot hope to escape liability on the ground that a defect which caused an injury was latent, or even that it could not have been discovered without special tests. For example, where the contract is one of sale, and the purchased article is defective, "If the article or commodity offered or delivered does not in fact answer to the description of it in the contract, it does not do so more or less because the defect is patent or latent or discoverable" (*Randall v.*

Newsom<sup>30</sup>; *Bunn v. Harrison*<sup>8</sup>). (For examples, see Consequences of Accident—Death, p. 16; Injury, p. 18.)

**Implied Contracts.**—Implied contracts, or terms of contracts, are well illustrated, as far as personal injuries are concerned, by cases based on the conditions and warranties implied by the Sale of Goods Act.

The most common express or implied contracts, the breaches of which may cause personal injury or disease, are contracts by carriers, contracts for the hire of houses or the sale of goods.

**Carriers' Contracts.**—If a passenger by train or other vehicle by land, having taken a ticket, suffer personal injury by accident, he can sue for breach of the contract to carry him with due care. The plaintiff must prove the absence of due care; or, rather, he must at least show a *prima facie* case of its absence—*i.e.*, of negligence in the carrier. To defend successfully the carrier must then prove the use of due care, but he is not an insurer; when, therefore, an accident is caused by a latent defect—*e.g.*, a defect in an axle, undiscovered in spite of careful examination (*Readhead v. Midland Railway*<sup>31</sup>)—the carrier is not liable.

**Hiring Houses.**—In contracts for hiring houses, breach of express or implied terms which amount to a warranty or condition will give rise to an action for damages which arise from personal injury or disease due to the breach. Disease might be due to unsound drains which had been warranted sound at the time of taking the house. *De Lassalle v. Guildford*<sup>13</sup> decides that such a warranty may be a condition precedent to the accepting of the lease, although the warranty was not mentioned in the written document itself; and the defendant was held liable thereon, although the drains would have had to be specially and carefully tested to discover the default. Unfurnished houses, unless they come within the scope of the Housing of the Working Classes Act, are probably not let with any implied warranty that they are, at the time of letting, "reasonably fit for human habitation" (but see *Bunn v. Harrison*<sup>8</sup>); such a warranty is implied in the letting of furnished houses, at all events, if for a short period (*Smith v. Marrable*<sup>37</sup>; *Sutton v. Temple*,<sup>40</sup> *per contra* *Chester v. Powell*<sup>11</sup>), though in no case is there an implied warranty that they will continue fit.

**Sale of Goods.**—The law on this subject is codified in the Sale of Goods Act, 1893, by which there are usually implied conditions under the ordinary conditions of purchase, as over the shop counter.

There are three main subsections of Section 14 of the Act dealing with warranties.

Some of the injuries resulting from breach of these implied conditions might be regarded as "accidents," others as "diseases."

"Where the buyer, expressly or by implication, makes known to the seller the particular purpose for which the goods are required, so as to show that the buyer relies on the seller's skill or judgment, and the goods are of a description which it is in the course of the seller's business to supply . . . there is an implied condition that the goods

shall be reasonably fit for such purpose" (Sale of Goods Act, Section 14 [1]).

"Where goods are bought by description from a seller who deals in goods of that description . . . there is an implied condition that the goods shall be of merchantable quality, provided that, if the buyer has examined the goods, there shall be no implied condition as regards defects which such examination ought to have revealed" (Sale of Goods Act, Section 14 [2]).

"An implied warranty . . . may be annexed by the usage of trade" (Sale of Goods Act, Section 14 [3]).

Illustrations of cases are given in the Consequences of Accident at p. 18.

#### IV. The Workmen's Compensation Act.

A successful claim to be made under this Act must be based upon a personal injury *by accident*, which must have *arisen out of and in the course of the employment*. This latter is discussed below, under Defences.

"*Personal Injury caused by Accident*" [W.C.A., I. (1) i].—In these proceedings it is essential to consider whether the injury in respect of which compensation is claimed is or is not an accident, for compensation can only be awarded when the injury is the result of an "accident"; and the word "accident" has, by a long course of judicial interpretation, acquired a special and possibly somewhat artificial meaning.

Before the passing of the Workmen's Compensation Acts, it is probable that the majority of the Judges would have agreed with the dictionary in defining an accident as a fortuitous and unexpected event. The result of the cases decided under these Acts has been to widen the word so as to include many events and diseased conditions which would not formerly have been called accidents.

Moreover, the word originally was used to denote the occurrence which caused the injury, and now is often extended to include the injury itself.

LORD MACNAGHTEN in *Fenton v. Thorley*<sup>16</sup> defined "accident" as follows: "Accident in the Workmen's Compensation Act is used in the popular and ordinary sense of the word as denoting an unlooked-for mishap or an untoward event which is not expected or designed. . . .

This case establishes the principle that an occurrence, arising out of and in the course of the employment, does not cease to be an accident within the Act merely because it is the result of an act done deliberately in ignorance of the results which might follow, nor does it cease to be an accident because, if all the facts had been known to the man at the time of the accident, he could have foreseen that an injury to him would probably be occasioned.

While it is clear that the word "accident" includes the injury as well as the event by which it is caused, yet it has clearly been established that, subject to the conditions set out in the third schedule, the gradual onset of disease is not an accident within the meaning of the term in the Workmen's Compensation Acts, and this is so even though it has been caused by the nature of the employment. This subject is also discussed below, under Defences.

*“Accident” Definition.*—The word “accident” under the Workmen’s Compensation Act therefore means an injury of which it may be affirmed that it was—

Sudden in onset—*i.e.*, attributable to a particular point of time, which, if not ascertained, is to be considered to be ascertainable (*Steel v. Cammell, Laird and Co.*<sup>38</sup>).

Unexpected—*i.e.*, unexpected at the point of time to which it is attributable (*Fenton v. Thorley*<sup>16</sup>).

### Medico-Legal Defences.

The following are indications of the principal defences which could have a medico-legal aspect. Other defences, such as the absence of notice in writing under the Workmen’s Compensation Act, the restrictions limiting the time within which action can be brought under the Fatal Accidents or Employers’ Liability Acts, and many other purely legal defences, are fully dealt with in the numerous legal textbooks, where will also be found a full description of the defences which are here mentioned.

(a) **Contributory Negligence and Serious and Wilful Misconduct.**—In this connection it is important to appreciate that circumstances of the nature of contributory negligence on the part of the injured person, which may afford a defence to an action brought at Common Law or under the Employers’ Liability Act, both being actions founded upon negligence, may not furnish any defence to proceedings instituted under the Workmen’s Compensation Act. Such a defence is not available under this last Act unless such negligence on the part of the applicant amounts to “serious and wilful misconduct,” as defined by the cases, and even then is not available where death or serious and permanent disablement results from the accident.

(b) **Inevitable Accident or Act of God.**—These would furnish a complete defence at Common Law or under the Employers’ Liability Act. For example, a street accident may occur without blame being attributable to any person, and in such case the person injured has no right of action for damages at all.

No one is responsible for an injury which arose from “An act of God,” which could not have been foretold (*Nichols v. Marsland*<sup>20</sup>). This is good law, notwithstanding the case of *Rylands v. Fletcher*<sup>33</sup> quoted above, where there was no such unusual or unexpected violence.

The special position under the Workmen’s Compensation Act is discussed under the last two defences (*h*) and (*i*).

(c) **Remoteness of the Consequences of the Injury.**—Remoteness of the “damages,” using this word as including the personal injuries which give rise to legal right of action, is a good defence to an action brought at Common Law, under the Employers’ Liability Act or Lord Campbell’s Act.

It is clear, from the decided cases, that the remoteness of the consequences of an accident is not a defence to a claim under the W.C.A. This is discussed below, under Consequences of Accident, p. 19; see *Dunham v. Clare*.<sup>14</sup>



(d) **Not the Natural and Probable Consequences of the Act causing the Injury.**—This defence, like the last, is not available under the Workmen's Compensation Act (see *Dunham v. Clare*,<sup>14</sup> *Ystradowen Colliery v. Griffiths*,<sup>43</sup> and *Hughes v. Clover Clayton*<sup>21</sup>). In other cases the law, as stated by BOVILL, J., in *Sharp v. Powell*, expresses the position of the injured party :

"No doubt one who commits a wrongful act is responsible for the ordinary consequences which are likely to result therefrom; but, generally speaking, he is not liable for damage which is not the natural or ordinary consequence of such an act, unless it be shown that he knows, or has reasonable means of knowing, that consequences not usually resulting from the act are, by reason of some existing cause, likely to intervene so as to occasion damage to a third person. Where there is no reason to expect it, and no knowledge in the person doing the wrongful act that such a state of things exists as to render the damage probable, if injury does result to a third person, it is generally considered that the wrongful act is not the proximate cause of the injury so as to render the wrongdoer liable to an action."

(e) **Novus Actus Interveniens.**—This is a good defence to an action or to a claim under an insurance policy, or even under the Workmen's Compensation Act. An example under this Act is seen in the case where a workman, in receipt of compensation, died from the anæsthetic administered for the removal of a decayed tooth, an operation in no way connected with the original injury, for which he had just undergone another operation, also under anæsthesia (*Shirt v. Calico Printers' Association*<sup>36</sup>).

Neither supervening disease, nor old age, as long as the incapacity due to the original accident remains, is a ground for ending an award under the Workmen's Compensation Act, and so cannot be considered as a *novus actus interveniens*; but if either of these causes disability to work after the effects of the accident have ceased, there is no right to compensation (see Case Guide: Age, Tumours, etc.).

(f) **Unreasonable Conduct of the Plaintiff (the Injured Man.**—By this we mean that the plaintiff has not done all he could to minimize his damage and reduce his loss. In one sense this is an example of the last defence (e); but for full discussion on this point, with regard to medical and other treatment of injuries sustained, see the section on Operation and Treatment, p. 24.

(g) **Able to Earn—i.e., the Incapacity has Ceased.**—The importance of this subject is greatest under the Workmen's Compensation Act, and is dealt with as a separate section on Cure and Return to Work at p. 31.

(h) **No "Accident."**—This is a defence strictly limited to claims made either under an insurance policy against accident or under the Workmen's Compensation Act. As has been already mentioned, inevitable accident is a defence at Common Law, but an accident is the foundation of a claim under the Workmen's Compensation Act.

(i.) *Idiopathic Disease is not an Accident (W.C.A.).*—This was the dictum of Lord Halsbury in *Brintons, Ltd., v. Turvey*<sup>5</sup> when he

held that the contracting of anthrax was an accident under the circumstances of the case.

(ii.) *Disease of Gradual Onset is not an Accident.*—This does not mean that a disease which commences at a determinable and ascertainable moment cannot be treated as an accident within the Act, apart from Section 8, for the last clause of that very section expressly preserves this right :

“ Nothing in this section shall affect the rights of a workman to recover compensation in respect of a disease to which this section does not apply, if the disease is a personal injury by accident within the meaning of this Act.”

For example, disease which is the result of the sudden intrusion of a noxious agent, such as a bacillus, may very well be an accident. Anthrax, under such circumstances, was held to be personal injury by accident in *Brintons, Ltd., v. Turvey*.<sup>5</sup>

In *Broderick v. The London County Council*,<sup>6</sup> a sewer-man contracted sewer-man's enteritis from the sewer-gas, and in consequence was disabled. Held not to be an accident. (Affirmed in *Eke v. Hart Dyke*,<sup>14a</sup> another case of sewer-gas poisoning.)

Before leaving this question, it should be noticed that the immediate accident may be only a new incident which is added to a pre-existing condition, the combination of which with the accident is really responsible for the ultimate result. A blow upon the chest of a healthy man would probably produce no symptoms, but even a slight strain might rupture an aneurism and cause death to a workman affected with this disease (*Hughes v. The Clover Clayton Colliery*<sup>21</sup>). The aneurism may have developed during a long period of time when the man may have been working for other masters; disease of the arteries, quite independent of work, may have been the primary cause, but the cause of death would none the less be an accident under the Workmen's Compensation Act.

The cases which enunciate the law that gradual diseases are not accidents are *Marshall v. East Holywell Coal Company*<sup>26</sup> (beat knee); *Gorley v. Backworth Coal Co, Ltd.*<sup>18</sup> (beat hand); *Steel v. Cammell Laird and Co., Ltd.*<sup>38</sup> (lead-poisoning). (*Walker v. Hockney Brothers*.<sup>42</sup>)

Some of the decisions are based on the words of the 1897 Act, Section 2 (1), which are identical with the words of Section 2 (1) of the 1906 Act.

In *Steel's case*, COLLINS, M.R., gave the following judgment on this point: “ In any case, the result must have come about through long exposure to contact with lead, and gradually, not suddenly. It is not possible to indicate any precise time at which the mischief arose. It seems to me that the provisions of Section 2 of the Act show that what is dealt with are the cases in which a date can be fixed as to that on which the injury by accident came about. I am unable to find such a date in this case.”

The actual subject-matters of these decisions upon beat hand, beat knee, and lead-poisoning, are now included in the third schedule of the Workmen's Compensation Act, which by Section 8 entitles the workman to recover compensation as if the disease were a personal injury by accident.

(2) **Not "arising out of and in the Course of the Employment."**—As has been stated above, "inevitable accident" would never, and "act of God" would not necessarily, furnish a defence to proceedings under the Workmen's Compensation Act; for here the sole question to be considered is not the moral responsibility of the master for the accident, but whether an accident happened and arose out of and in the course of the employment.

Unless the workman can prove that the accident occurred during the time, *i.e.*, "in the course of" the employment, and was a consequence of his work, *i.e.*, was "arising out of . . . the employment," he cannot recover under the Act. So that although the immediate cause of a particular accident may appear to be an act of God or an injury which the master could in no way be responsible for or control, yet the workman still may recover if he was exposed "in the course of his employment" in any exceptional degree to the danger which resulted in the accident, and which "arose out of his employment." Such accidental injuries arising in the course of the employment under the following circumstances have in some instances been held within the Act, and in other instances outside it. In the eye of the medical man some of them are not accidents.

*Lightning.*—LORD TRAYNER: "A servant engaged in a foundry yard, in the course of his employment struck by lightning and severely maimed, would have no claim for compensation under the Act." (*Falconer v. London and County Engineering Company*.<sup>15</sup>)

In *Kelly v. The Kerry County Council*,<sup>24</sup> the Irish Court of Appeal came to the same conclusion, holding there was no special exposure; but in *Andrew v. Failsworth*<sup>1</sup> the Court of Appeal in England held the workman was within the Act, since he was especially exposed to danger from lightning, by reason of his being set to work upon a high scaffold.

*Sunstroke.*—A sailor in the tropics when painting the outside of a ship, was struck by the sun, and was held to be within the Act (*Morgan v. The s.s. Zenaida*<sup>27</sup>).

*Heatstroke.*—A trimmer, in the stokehole of a ship, was attacked by a heatstroke, and was held to be within the Act (*Ismay, Imrie and Co. v. Williamson*<sup>22</sup>).

*Frostbite* (County Court).—A labourer who was removing snow was frostbitten. Judge Selfe, at the Marylebone County Court, held this was within the Act (*Holleron v. The Kensington Borough Council*<sup>20</sup>). Judge Willis at Greenwich, in the case of a sailor, expressed a contrary view in *Stricer v. The schooner Winifred*.<sup>30</sup>

*Animals.*—In *Rowland v. Wright*<sup>32</sup>, an employé engaged to do stable work was bitten by the stable cat, and was held entitled to receive compensation under the Act.

*Insects.*—A servant-girl, seeing a cockchafer fly at her, put up her hand to prevent the insect hitting her face, and in so doing injured her eye. This was held to be an accident which did not arise out of the employment, though it was in the course of it (*Craske v. Wigan*<sup>12</sup>).

In *Happelman v. Poole*,<sup>19</sup> a servant was temporarily left in charge of the lions in a menagerie, and he was killed when trying to drive a lion back into its cage. This was held to arise out of his employment.

## CASES.

- <sup>1</sup> Andrew v. Failsworth Industrial Society, 1904, 2 K.B., 32; 73 L.J., K.B., 510; 90 L.T., 611; 52 W.R., 451; 20 T.L.R., 429; 68 J.P., 409; 6 W.C.C., 11. (Lightning.) [*c.g.*, Electricity, 932.]
- <sup>2</sup> Atherton v. London and North-Western Railway, 21 T.L.R., 671. (Injury to eye; Statutory powers.) [*c.g.*, Eye, 941.]
- <sup>3</sup> Batcheller v. Tunbridge Wells Gas Light and Coke Company, 1901, 84 L.T., 765. (Gas escaped and polluted water.) [*c.g.*, Poisons, 104.]
- <sup>4</sup> Blyth v. Birmingham Waterworks Company, 1856, 11 Ex., 781. (Negligence defined; Frost caused escape of water.) [*c.g.*, Cold, 911.]
- <sup>5</sup> Brintons v. Turvey, 1905, A.C., 230; 74 L.J., K.B., 474; 92 L.T., 578; 53 W.R., 641; 21 T.L.R., 444; 7 W.C.C., 1. (Anthrax.) [*c.g.*, Anthrax, 877.]
- <sup>6</sup> Broderick v. The London County Council, 1908, 24 T.L.R., 822; 1 B.W.C.C., 219. (Sewer-men's enteritis.) [*c.g.*, Intestines, 978.]
- <sup>7</sup> Box v. Jubb, 1879, 4 Ex. D., 76; 48 L.J., Ex., 417. (Water escaped; Act of stranger.)
- <sup>8</sup> Bunn v. Harrison, 3 T.L.R., 146. (Express warranty of furnished house.) [*c.g.*, Infection, 967.]
- <sup>9</sup> Byrne v. Boadle, 33 L.J., Ex., 13. (*Res ipsa loquitur*—Falling sack of flour.) [*c.g.*, Wound, 1082.]
- <sup>10</sup> Carstairs v. Taylor, 1871, L.R. 6 Ex., 217; 1887, 40 L.J., Ex., 29; 12 App. Cas., 518. (*Vis major*—Water escape; Rats.)
- <sup>11</sup> Chester v. Powell, 1885, 52 L.T., 722. (Water runs dry during tenancy.) [*c.g.*, Infection, 967.]
- <sup>12</sup> Craske v. Wigan, 1909, 1 K.B., 371; 2 B.W.C.C., 35. (Cockchafer Accident.) [*c.g.*, Eye, 943.]
- <sup>13</sup> De Lassalle v. Guildford, 1901, 2 K.B., 215; 70 L.J., K.B., 533; 84 L.T., 549; 49 W.R., 467. (Drains warranted before lease accepted.) [*c.g.*, Infection, 967.]
- <sup>14</sup> Dunham v. Clare, 1902, 2 K.B., 292; 4 W.C.C., 102. (Erysipelas after injury.) [*c.g.*, Infection, 971.]
- <sup>14a</sup> Eke v. Hart Dyke, *Times*, July 13, 1910. (Sewer-gas poisoning.) [Intestines, 978.]
- <sup>15</sup> Falconer v. The London and Glasgow Engineering Company (Scotland), 1902, 3 F., 564; 38 S.L.R., 381; 8 S.L.T., 430. [*c.g.*, Accident, 11.]
- <sup>16</sup> Fenton v. Thorley, 1903, A.C., 443; 19 T.L.R. 684; 72 L.J., K.B., 787; 89 L.T., 314; 52 W.R., 81; 5 W.C.C., 1. (Rupture.) [*c.g.*, Rupture, 1052.]
- <sup>17</sup> Frost v. Aylesbury Dairy Company, 1905, 1 K.B., 608. (Typhoid fever from milk.) [*c.g.*, Death, 921; Intestines, 978.]
- <sup>18</sup> Gorley v. Backworth Coal Company, Ltd., 1905, 93 L.T., 360; 21 T.L.R., 494; 7 W.C.C., 19. (Beat knee.) [*c.g.*, Beat Hand, 800.]
- <sup>19</sup> Happelman v. Poole, C.A., 1909; 25 T.L.R., 155; 2 B.W.C.C., 48. (Lion-keeper's death.)
- <sup>20</sup> Holleron v. Kensington Borough Council (County Court). (Frost-bite.) [*c.g.*, Cold, 912.]
- <sup>21</sup> Hughes v. Clover Clayton, 25 T.L.R., 760; 2 B.W.C.C., 15. (Aneurism burst.) [*c.g.*, Vessels, 1079.]
- <sup>22</sup> Ismay, Imrie and Co. v. Williamson, 24 T.L.R., 882; 1 B.W.C.C., 232. (Heatstroke.) [*c.g.*, Heat, 961.]
- <sup>23</sup> Kearney v. London, Brighton and South Coast Railway, 1871, L.R., 6 Q.B., 759; 40 L.J., Q.B., 285. (*Res ipsa loquitur*—Brick falls from railway arch and wounds.) [*c.g.*, Wounds, 1082.]
- <sup>24</sup> Kelly v. The Kerry County Council, 1908, 42 I.L.T., 23; 1 B.W.C.C., 194. (Lightning.) [*c.g.*, Electricity, 932.]
- <sup>25</sup> Madras Railway v. Zemindar of Carvatenagaram, L.R., 1 Ind. App., 364; 14 Ben. L.R., 209.
- <sup>26</sup> Marshall v. East Holywell Collieries, 21 T.L.R., 494; 93 L.T., 360; 7 W.C.C., 19. (Beat hand.) [*c.g.*, Beat Hand, 880.]
- <sup>27</sup> Morgan v. The S.s. *Zenaida*, 25 T.L.R., 446; 2 B.W.C.C., 19. (Sunstroke.) [*c.g.*, Tropics, 1073.]
- <sup>28</sup> National Telephone v. Baker, 1893, 2 Ch., 186; 62 L.J., Ch., 699. (Injury by electricity; Statutory powers.) [*c.g.*, Electricity, 930.]
- <sup>29</sup> Nichols v. Marsland, 1876, 2 Ex. Div.; 46 L.J., Ex., 174; 35 L.T., 725; 25 W.R., 173. (Act of God.) [*c.g.*, Wounds, 1087.]

- <sup>30</sup> *Randall v. Newsom*, 2 Q.B.D., 101. (Latent defect in carriage-pole.) [*c.g.*, Wounds, 1083.]
- <sup>31</sup> *Readhead v. Midland Railway, L.R.*, 4 Q.B., 379. (Latent defect; Railway company not liable for accident.) [*c.g.*, Wounds, 1085.]
- <sup>32</sup> *Rowland v. Wright*, 1908, 24 T.L.R., 852; 1 B.W.C.C., 192. (Cat-bite in stable.) [*c.g.*, Wounds, 1085.]
- <sup>33</sup> *Rylands v. Fletcher*, 37 L.J., Ex., 161; 19 L.T., 220. (Storing of dangerous water.) [*c.g.*, Wounds, 1080, 1087.]
- <sup>34</sup> *Scott v. Shepherd*, 2 B.W.C., 392; 1 Sm.L.C. 11th Edn. 454. (Assault; Proximate cause—Squib in eye.) [*c.g.*, Eye, 934.]
- <sup>35</sup> *Sharp v. Powell*, 1841, L.R., 7 C.P., 253; L.J., C.P., 95. (Damages too remote; Ice on road.) [*c.g.*, Cold, 910.]
- <sup>36</sup> *Shirt v. Calico Printers*, 1909, 2 K.B., 51; 2 B.W.C.C., 342. (Death after operation.) [*c.g.*, Anæsthetics, 875.]
- <sup>37</sup> *Smith v. Marrable*, 11 M. and W., 5; 12 L.J., Ex., 223. (Implied warranty in furnished houses; Bugs.) [*c.g.*, Infection, 969.]
- <sup>38</sup> *Steel v. Cammell, Laird and Co.*, 1905, 2 K.B., 232; 74 L.J., K.B., 610; 93 L.T., 357; 53 W.R., 612; 21 T.L.R., 490; 7 W.C.C., 9. (Lead-poisoning.) [*c.g.*, Poisons—Lead, 1047.]
- <sup>39</sup> *Stricer v. The schooner Winifred* (County Court). (Frost-bite.) [*c.g.*, Cold, 912.]
- <sup>40</sup> *Sutton v. Temple*, 12 M. and W., 52. (Hire of grass land; Animals die from poisonous paint in grass.) [*c.g.*, Poisons—Lead, 1046.]
- <sup>41</sup> *Vaughan v. Taff Vale Railway*, 5 H. and N., 679; 29 L.J., Ex., 247. (Fire from railway spark; Statutory powers.) [*c.g.*, Heat, 960.]
- <sup>42</sup> *Walker v. Hockney Brothers*, 2 B.W.C.C., 20. (Work paralysis is not accident.) [*c.g.*, Nerves, 1024.]
- <sup>43</sup> *Ystradowen Colliery v. Griffiths*, 1909, 2 K.B., 533; 2 B.W.C.C., 357. (Chronic asthma after injury to knee.) [*c.g.*, Lungs, 991.]

## CONSEQUENCES OF ACCIDENT.

The person legally responsible for personal injury to another *may* be held liable for all the consequences of the cause producing injury or traceable to it, and the consequences so arising may go on increasing until, by a final judgment or award, a limit is put to the liability. No defence is available in the fact that an utterly trivial injury has produced results the serious nature of which is out of all proportion to the force which inflicted it, provided that such results are the natural and reasonable consequences of the injury, having regard to all the facts existing at the time. For example, it may be no defence that the ultimate result is due to the aggravation of an old disease in existence before the injury, or that the consequences would have been less serious but for the weak health or condition of the plaintiff (*Dulieu v. White*<sup>14</sup>; *Lloyd v. Sugg*<sup>24</sup>; *Golder v. Caledonian Railway*<sup>18</sup>).

The consequences of an accident (and in that term we include injuries due both to negligence and to breach of contract) may be either—

Death or

Personal but non-fatal injury, direct or indirect (including disease).

### I. Insurance Policy.

A policy of insurance against death always presents the same legal position; the exact words of the policy are all-important. Death from certain causes—*e.g.*, disease—may be excluded by express terms, and the policy may be restricted to cases of death due “*solely to external, violent, accidental and visible means.*”

The interpretation placed upon the words of the various policies which have come before the Courts has at times brought within the policy cases where the cause of death was apparently excluded in express terms. There are numerous cases illustrating these or like words in policies in the Case Guide, under the heads Appendix, Brain (Epilepsy), Death, Heart, Infection, Joints, Lungs (Pneumonia), Poisons, Wounds. The insurance case is usually placed at the commencement of each section.

By the Fatal Accidents (Damages) Act (8 Ed. VII., c. 7), the sums of money paid or payable under a contract of insurance are not to be taken into consideration in assessing the damages under the Fatal Accidents Acts (Lord Campbell's Acts).

## II. Negligence.

(a) Sudden death ; (b) death after an interval of time.

(a) **Sudden Death.**—When death is due to negligence, it is only by statute that any damages can be recovered for the losses caused by the death itself—losses which must be kept distinct from any which may have been inflicted in the interval between injury and death. The common law of England is clear: "In a civil court the death of a human being could not be complained of as an injury" (*Baker v. Bolton*<sup>1</sup>). But statutes have modified this law, and under certain conditions there may be a right of action for damages for death caused by negligence ; so that, unless the plaintiffs can prove that their case is within some statute giving them special rights for damages for death due to negligence, the common law holds good, whatever form the action may take. But even under statutes permitting action for damages, nothing can be recovered for the mental pain and suffering which death causes to survivors (*Blake v. The Midland Railway*<sup>6</sup>).

Independently of the W.C.A., an action for damages caused by negligence producing death can only be brought under Lord Campbell's Act or under the Employers' Liability Act, with which is incorporated Lord Campbell's Act.

There are several essentials for success. The first is that the person claiming be one to whom the Act applies.

A list of the class of persons on whose behalf such action may be instituted under Lord Campbell's Act is set out in Sections 2 and 5 of the Act. The amount recoverable under Lord Campbell's Act is indefinite, being proportional to the pecuniary loss sustained ; but if the action is brought under the Employers' Liability Act, such pecuniary loss is limited to "an amount equal to the estimated earnings during the three years preceding the injury of a man in the same grade of work and district as the injured man," who must be a "workman" within the Act.

The second essential is that the plaintiff must have sustained some loss, as a claim can only be made for the pecuniary loss, or reasonable anticipation of pecuniary loss, caused by the death. No matter how culpable the negligence, vindictive damages cannot be awarded, neither can the mental pain and suffering of the relatives be taken into consideration. The essentials of such an action are well set out by

COCKBURN, C.J., in the case of *Pym v. The Great Northern Railway Company*<sup>34</sup>:

“A reasonable expectation of pecuniary advantage, the extinction of such expectation by negligence, occasioning the death of the party from whom it arose, will sustain action; it is for the jury to say . . . whether there was such reasonable and well-founded expectancy.”

The reasonableness of such expectation may be evidenced by proof that the deceased habitually supported those on behalf of whom the claim is made, as in the case of a parent, or that the deceased contributed to a common fund for household expenditure, as is so often the case in certain classes of life. That a reasonable anticipation is sufficient, even where no actual support or contribution had in fact been given, is shown by the case of *Franklin v. The South-Eastern Railway Company*,<sup>16</sup> where POLLOCK, C.B., in his judgment says:

“We do not say that it was necessary that actual benefit should have been derived; a reasonable expectation is enough, and such reasonable expectation might well exist, though, from the father’s not being in need, the son had never done anything for him.”

It has been decided that funeral expenses are not part of the damages recoverable under Lord Campbell’s Act (*Dalton v. South-Eastern Railway*,<sup>18</sup> and *Clarke v. The L.G.O. Company*<sup>9</sup>), so from analogous medical expenses would not be recoverable.

Loss of services or companionship is not a loss for which a claim can be made under the Act (*Baker v. Bolton*<sup>1</sup>).

The next essential is that there would have been a right of action in the deceased had he survived. The survivors will have to found their action on the same rights as the deceased, and will have to meet every defence available against the deceased.

BOWEN, L.J.: “The killing of the deceased, *per se*, gives no right of action at all, either at law or under Lord Campbell’s Act” (*The Vera Cruz* [No. 2]<sup>41</sup>, *Roe v. Lalouette*<sup>35</sup>).

Again, such a statute of limitations as the Public Authorities Protection Act may stop all claims. (For cases, see Case Guide—Death, *Williams v. The Mersey Docks*<sup>44</sup>).

(b) **Death after an Interval of Time.**—The deceased man during his lifetime had rights, and his survivors also have rights. The rights of the deceased during his lifetime are discussed below, under Injury of a Non-Fatal Nature. These rights, even under the statute of Edward III., do not pass to the personal representatives of the deceased, and even though action was commenced before death for pain, suffering, and medical expenses, that action is personal, and the maxim *Actio personalis moritur cum persona* applies (*Pulling v. The Great Eastern Railway*<sup>33</sup>).

It is a possibility that, where the estate of the deceased was injured during his life through his being unable to attend to business in consequence of an illness caused by negligence, there would be a right of action, which descends under the statute of Edward III. and thus allows his executors to sue for damage to the estate (4 Ed. III., c. 7).

But, independently of these rights, which in one sense descend through the deceased man to the survivors, there are other losses

which are legally a subject for a claim for damages. Loss of services sustained by husband, father or master (*Baker v. Bolton*,<sup>1</sup> and see the judgment of Gorell Barnes, P., in *Clarke v. London General Omnibus Company*<sup>9</sup>), loss of companionship by a spouse—certainly by a husband, and perhaps by a wife (*Lynch v. King*<sup>24</sup>)—can be made a subject of action. It is submitted that, in such an action, the medical expenses to which a husband or father had been put, since they are necessities which he is bound to supply, could be recovered as part of his special damages.

### III. Breach of Contract.

Here, again, the death may occur either immediately or after an interval of time; and the contract may be between two persons, one of whom dies in consequence of the breach, or between two persons who survive, but one of whom suffers damages through the death of a third person, due to the breach.

**Sudden Death**—(i.) *Of One of the Contracting Parties*.—The principle is the same as that discussed above under Negligence, except that the Fatal Accidents Acts apply to actions for negligence only, and not for breach of contract.

(ii.) *Of a Third Party*.—Where the breach causes death of a third party, one of the two contracting parties may suffer damage by the death. A husband or master may so suffer damages by the death of wife or servant, as, for instance, where death was caused by eating food supplied under a warranty implied by the Sale of Goods Act (*Frost v. The Aylesbury Dairy Company*,<sup>17</sup> and *Jackson v. Watson*<sup>21</sup>). In the latter case the action was for breach of contract; the death was not the ground of the action, but damages resulting from the death were recoverable.

VAUGHAN WILLIAMS, L.J.: “On the whole, I have come to the conclusion that this one exception from the general principle on which damages are based only applies to cases where the cause of action is the wrong which caused the death, and does not apply to cases where there is a cause of action independently of such wrong” (*Jackson v. Watson*<sup>21</sup>). (The exception was that the causing of the death of a human being was not an actionable wrong.)

**Death after an Interval of Time**—(i.) *Of One of the Contracting Parties*.—The position of an injured person during his lifetime is discussed below, p. 18. But where the deceased has been put to expenses during his lifetime—*e.g.*, medical expenses—his personal representative can sue for and recover these, as was done in *Bradshaw v. Lancashire and Yorkshire Railway*.<sup>7</sup> “The plaintiff can recover, as it was an action for contract, not tort.”

So, too, it appears that the personal representative can sue for damages to the estate of the deceased due to his not being able to attend to his business (*Knights v. Quarles*<sup>22</sup>).

(ii.) *Of a Third Party*.—The position is the same as that discussed above, where sudden death occurs.

**The Workmen's Compensation Act**.—If death result to a workman, and the master is liable to pay compensation in the ordinary case, payment will have to be made to (or into Court on behalf of) the “dependants of the deceased.”



If there are dependants, whether total or partial, their rights are distinct from those of the deceased workman (*Williams v. The Vauxhall Colliery*<sup>45</sup>); but all payments made to the deceased man as compensation, whether by way of weekly payments or lump sums, must be deducted from the maximum payable to them (W.C.A., Schedule 1, [1], a, [i.]). If at the time of death there is any compensation due to the workman, it devolves on the personal representatives of the deceased workman, who are not necessarily the dependants (*United Collieries v. Hendry*<sup>42</sup>).

Partial dependants receive a sum which is not to exceed the amount payable to total dependants, but is reasonable and proportionate to their loss (W.C.A., Schedule 1, [1], a, [ii.]). What this sum will be is a question in any given case for the arbitrator (*Littleford v. Connell*<sup>23</sup>), but may be nearly as much as total dependants could receive.

In the case of death where there are no dependants total or partial, a sum not exceeding £10 is by the Act itself allowed for medical or funeral expenses. In cases where persons wholly dependant upon the deceased have to be compensated, medical and funeral expenses are not taken into consideration; for the Act, as shown above, provides for payment of an arbitrary sum without regard to the amount actually expended or due for medical services or to the funeral expenses of the deceased. But in cases of partial dependancy, in considering the extent of injury which has been occasioned to the dependants, the arbitrator is entitled to, and it is submitted should, take into consideration medical and funeral expenses in determining the amount to award, subject, of course, to the total sum awarded being not in excess of the maximum fixed by statute.

That funeral expenses may under such circumstances be allowed was decided in the cases of *Bevan v. Crawshay Brothers*<sup>4</sup> in the English Courts, and by *Hughes v. Summerlee*,<sup>20</sup> and *Murray v. Gourlay*<sup>29</sup> in the Scottish Courts. It would seem that the considerations which entitle funeral expenses to be taken into consideration apply equally to the case of medical expenses, and this seems to have been the view taken by the Court in the two Scottish cases mentioned.

A very important medico-legal fact about claims by dependants under the Workmen's Compensation Act is the capacity conferred upon the Judge to draw inferences as to the cause of death. Where a death occurs, and there is no clear evidence as to how it occurred, the Judge can draw an inference that the death was caused by "personal injury by accident arising out of and in the course of the employment." Cases where the inference has or has not been drawn, are separately classified in the Case Guide (Death) under Workmen's Compensation Act, p. 923.

Whether death is under any particular circumstances the result of an admitted accident is a question of fact for the arbitrator (*Warnock v. Glasgow Iron Co.*,<sup>43</sup> and *Connell v. Barr*<sup>11</sup>); it is open to the arbitrator to find that even suicide is death caused by the accident (*Malone v. Cayzer*<sup>27</sup>); but there may be a defence that it was not "arising out of and in the course of the employment."

For further notes on Death, see Operation, p. 24; Case Guide—Death, p. 913.

### Injury, Direct or Indirect, including Disease.

1. **Insurance Policies.**—The nature of the claim is sufficiently dealt with above, under the claims in the case of death.

2. **Negligence.**—The fact that the injured man was in weak health or in an unusual condition is not relevant (*Dulieu v. White*,<sup>14</sup> and *Lloyd v. Sugg*<sup>24</sup>). The Case Guide is largely composed of reports of cases of injury by negligence to healthy or diseased persons, who have under various circumstances recovered compensation for injuries to nearly every part of the body. The nature of the various kinds of disease resulting from negligence is discussed under the head Disease.

Independently of the W.C.A., the plaintiff can claim damages based upon actual losses if not too remote, and a sum for pain and suffering, medical attendance, and all the usual accessories incidental to recovery, such as nursing, convalescent home, etc.

In many of these cases, although the action is ostensibly one for negligence, yet it is really based on the principles laid down in *Rylands v. Fletcher*<sup>36</sup> (see above, Accident, p. 4), as to damages caused by the concentration and escape of dangerous forces. The consequences of the escape will in some instances be called in popular language "accidents," in others "disease."

The principle of *Rylands v. Fletcher* is illustrated by the following cases, though they are not all cases of personal injury: Wild animals (*feræ naturæ*)—monkey (*May v. Burdett*<sup>28</sup>); sewage or filth (*Tenant v. Goodwin*,<sup>40</sup> and *Ballard v. Tomlinson*<sup>2</sup>); gas contaminating water (*Batcheller v. Tunbridge Wells Gas Company*<sup>3</sup>); electricity escaping (*National Telephone Company v. Baker*<sup>30</sup>); bacteria—diphtheria (*Sherwell v. Alton Urban Council*<sup>37</sup>); poisonous trees (*Crowhurst v. Amersham District Council*<sup>12</sup>).

3. **Breach of Contract.**—Where personal injuries or diseases are directly traceable to breach of contract, the legal position is much the same as regards the consequences as if the action had been brought for damages caused by negligence. Given the legal wrong, whether negligence or breach of contract, the guilty person is responsible for his conduct and for what flows from it.

There are many cases of breach of express or implied contracts in the Case Guide. The following are instances of accident, disease, or inconvenience in connection with the hiring of houses and sale of goods:

**HIRING HOUSES** (see also above, p. 6).—*Smith v. Marrable*<sup>39</sup> (bugs); *Wilson v. Finch Hatton*<sup>46</sup> (defective drains); *Bird v. Lord Greville*<sup>5</sup> (measles).

**SALE OF GOODS.**—(a) Sale of Goods Act, Section 14 (1):

*Burn.*—A defective hot-water bottle burnt the wife of the purchaser (*Preist v. Last*<sup>32</sup>).

*Ptomaine-Poisoning.*—A kipper eaten in a restaurant was alleged the source of an illness considered as ptomaine-poisoning. The case was unsuccessful, but illustrates the principle (*Hands v. Slaters, Ltd.*<sup>19</sup>).

*Tooth Broken.*—A bun purchased in a shop contained a stone which broke the purchaser's tooth (*Chapronière v. Mason*<sup>10</sup>).

*Typhoid Fever.*—The plaintiff purchased milk which gave his wife typhoid fever (*Frost v. Aylesbury Dairy Company*<sup>17</sup>).

(b) Sale of Goods Act, Section 14 (2):

*Arsenical Poisoning in Beer.*—The plaintiff purchased Holder's beer, and suffered from poisoning caused by arsenic in the beer (*Wren v. Holt*<sup>47</sup>).

4. **The Workmen's Compensation Act.**—"Loss of capacity for work," and that alone, is the basis of payments under this Act. A. L. SMITH, M.R., in *Pomphrey v. The Southwark Press*,<sup>31</sup> stated the law on that point in 1900: "Compensation under the Act is given in respect of loss of wages, and not in respect of personal suffering."

All that can be recovered is half the average weekly earnings (ascertained in the manner provided in the Act), with a maximum limit of £1 weekly. After a certain period the master, but not the man, can apply to have the weekly payments redeemed for a lump sum.

If the arbitrator decides that no disability remains, he will ordinarily award in favour of the employer; but if he is of opinion that the incapacity may recur, he will probably make, and is entitled to make, a nominal award or a declaration of liability, which leaves it open to the workman to apply again if the incapacity recurs, (For this see below, Cure and Recurrence.)

Under the W.C.A. it would seem that it is not even necessary that the injuries in respect of which compensation is claimed should be the natural and probable consequence of the accident; it is sufficient merely to show that the injuries were in fact caused by the accident, and were not due to an independent intervening cause (*Dunham v. Clare*<sup>15</sup>).

"It is quite consistent to say that death resulted from the injury, and yet that it was neither the natural nor the probable consequence of it. If no new cause, no *novus actus*, intervenes, death has in fact resulted from the injury. . . ."—COLLINS, M.R.

This case was recently quoted with approval by Cozens-Hardy, M.R., in *Ystradowen Colliery Company v. Griffiths*.<sup>48</sup> Here the applicant injured his knee when at work, and in consequence had to take a long walk home in the cold. His lowered condition was proved to have caused him to contract pneumonia, which left behind it chronic bronchitis and asthma.

The Court of Appeal held, in respect of the bronchitis and asthma, that he was still suffering from disablement by the accident:

"The test was not whether the man's condition was a natural result of the accident, but whether it was the result of the accident in the sense that it was occasioned by the debilitated condition of the man immediately after the accident."—COZENS-HARDY, M.R.

Further, under the W.C.A., the employer may be held responsible for incapacity produced by unsuccessful medical and surgical treatment, operative or otherwise, provided such treatment was reasonably undergone by the injured workman with the object of diminishing the incapacity (*Shirt v. The Calico Printers' Association*<sup>38</sup>). The respondent in such cases must accordingly anticipate being held responsible for a number of comparatively remote consequences, some of which are hereafter discussed under the separate headings Disease and Operation.

## CASES.

- <sup>1</sup> Baker v. Bolton, 1 Camp., 493. (Death; Damages under Fatal Accidents Act.) [*c.g.*, Death, 916.]
- <sup>2</sup> Ballard v. Tomlinson, 1885, 29 C.D., 115; 54 L.J., Ch., 454. (Sewage affected water.) [*c.g.*, Infection, 966.]
- <sup>3</sup> Batcheller v. Tunbridge Wells Gas and Coke Company, 1901, 84 L.T., 765. (Gas contaminated water) [*c.g.*, Poisons, 1044.]
- <sup>4</sup> Bevan v. Crawshaw Brothers, 1902, 1 K.B., 25. (Partial dependants may recover funeral expenses.) [*c.g.*, Medical Men, 1014.]
- <sup>5</sup> Bird v. Greville, 1884, C. and E., 361. (Measles in furnished houses.) [*c.g.*, Infection, 968.]
- <sup>6</sup> Blake v. Midland Railway, 1852, 18 Q.B., 93. (Death; No damages for pain to survivor.) [*c.g.*, Death, 915.]
- <sup>7</sup> Bradshaw v. Lancashire and Yorkshire Railway, 1873, L.R., 10 C.P., 190. (Death; Breach of contract; Action by personal representative) [*c.g.*, Death, 921.]
- <sup>8</sup> Brintons, Ltd., v. Turvey, 1905, A.C., 230, 74 L.J., K.B., 474; 92 L.T., 578
- <sup>21</sup> T.L.R., 444; 7 W.C.C., 1. (Anthrax.) [*c.g.*, Anthrax, 877.]
- <sup>9</sup> Clarke v. The London General Omnibus Company, 1906, 2 K.B., 648; 75 L.J., K.B., 907. [*c.g.*, Death, 916.]
- <sup>10</sup> Chapronière v. Mason, 21 T.L.R., 633. (Tooth broken by stone in bun.) [*c.g.*, Teeth, 1069.]
- <sup>11</sup> Connell and Co. v. Barr, 116, L.T.J., 127. [*c.g.*, Alcohol, 865.]
- <sup>12</sup> Crowhurst v. Amersham District Council, 1878, 4 Ex. D., 5; 48 L.J., Ex., 109. (Poisonous yew-tree.) [*c.g.*, Poisons—Yew, 1049.]
- <sup>13</sup> Dalton v. The South-Eastern Railway Company, 3 H. & N., 311.
- <sup>14</sup> Dulieu v. White, 1901, 2 K.B., 669; 70 L.J., K.B., 837. (Shock to weakened lady.) [*c.g.*, Neurasthenia, 1025.]
- <sup>15</sup> Dunham v. Clare, 1902, 2 K.B., 292; 71 L.J., K.B., 683; 86 L.T., 751; 50 W.R., 596; 66 J.P., 612; 18 T.L.R., 645; 4 W.C.C., 102. (Erysipelas after injury.) [*c.g.*, Infection, 971.]
- <sup>16</sup> Franklin v. The South-Eastern Railway Company, 1858, 4 C.B., 296. (Funeral expenses not recoverable under Lord Campbell's Act.) [*c.g.*, Death, 918.]
- <sup>17</sup> Frost v. Aylesbury Dairy Company, C.A., 21 T.L.R., 300. (Typhoid from milk.) [*c.g.*, Death, 921.]
- <sup>18</sup> Golder v. The Caledonian Railway Company, 40 S.L.R., 89; 10 S.L.T., 373. (Kidney disease.) [*c.g.*, Kidney, 987.]
- <sup>19</sup> Hands v. Slaters, Ltd. (Ptomaine-Poisoning—Kipperd herring.) [*c.g.*, Ptomaine-Poisoning, 1051.]
- <sup>20</sup> Hughes v. Summerlee, 1903, 5 F., 785. (Partial dependant and funeral expenses.) [*c.g.*, Medical Men, 1014.]
- <sup>21</sup> Jackson v. Watson, 1909, 2 K.B., 193. (Ptomaine-Poisoning—Salmon.) [*c.g.*, Death, 920.]
- <sup>22</sup> Knights v. Quarles, 2 Brod. and B., 104. [*c.g.*, Death, 921.]
- <sup>23</sup> Littleford v. Connell, 1909, 3 B.W.C.C., 1. (Partial dependants, loss to.) [*conseq. of acc.*, 17.]
- <sup>24</sup> Lloyd v. Sugg, 16 T.L.R., 65; 2 W.C.C., 5. (Injury to gouty thumb.) [*c.g.*, Joints, 984.]
- <sup>25</sup> Lynch v. Knight, 1861, 9 H.L.C., 577 at 589. [*c.g.*, Death, 919.]
- <sup>26</sup> M'Innes v. Dunmuir, 1908, 45 S.L.R., 804; 1 B.W.C.C., 226. (Hæmorrhage from diseased arteries of the brain.) [*c.g.*, Brain, 896.]
- <sup>27</sup> Malone v. Cayzer and Co., 1908, S.C., 479; 1 B.W.C.C., 27. (Suicide.) [*c.g.*, Insanity, 977.]
- <sup>28</sup> May v. Burdett, 1846, 9 Q.B., 101; 16 L.J., Q.B., 634. (Monkey-bite.) [*c.g.*, Wounds, 1080.]
- <sup>29</sup> Murray v. Gourlay, 1908, 47 S.C., 479. (Medical expenses.) [*con. of acc.*, 17.]
- <sup>30</sup> National Telephone Company v. Baker, 1903, 2 Ch., 186; 62 L.J., Ch., 454. (Electricity escapes.) [*c.g.*, Electricity, 930.]
- <sup>31</sup> Pomphrey v. The Southwark Press, 70 L.J., K.B., 48; 83 L.T., 468; 65 J.P., 148; 17 T.L.R., 53; 3 W.C.C., 194. (No damages, only compensation for loss of wages.) [*con. of acc.*, 19.]
- <sup>32</sup> Preist v. Last, 1903, 2 K.B., 148; 19 T.L.R., 278 and 527. (Burn from hot-water bottle.) [*c.g.*, Heat, 961.]
- <sup>33</sup> Pulling v. Great Eastern Railway, 1882, 9 Q.B.D., 711. (Death of plaintiff; Action does not descend to personal representative; Negligence.) [*c.g.*, Death, 919.]

- <sup>34</sup> *Pym v. The Great Northern Railway Company*, 1862, 31 L.J., Q.B., 248, 252. (Death; Reasonable expectation of pecuniary advantage.) [*c.g.*, Death, 918.]
- <sup>35</sup> *Roe v. Lalouette*, 1858, 9 Ir.C.L.R., 9. (Death from horse exercised in street.) [*c.g.*, Death, 915.]
- <sup>36</sup> *Rylands v. Fletcher*, L.R. 3 H.L., 330, 31 L.J., Ex., 161; 19 L.T., 22. (Storing of dangerous water.) [*c.g.*, Wounds, 1080.]
- <sup>37</sup> *Sherwell v. Alton Urban Council*, 25 T.L.R., 417. (Diphtheria.) [*c.g.*, Infection, 967.]
- <sup>38</sup> *Shirt v. The Calico Printers' Association*, 1909, 2 K.B., 51; 2 B.W.C.C., 342. (Death under anæsthetic.) [*c.g.*, Anæsthetics, 875.]
- <sup>39</sup> *Smith v. Marrable*, 11 M. and W., 5; 12 L.J., Ex., 223. (Bugs in furnished houses.) [*c.g.*, Infection, 969.]
- <sup>40</sup> *Tenant v. Goodwin*. (Sewage contaminates.)
- <sup>41</sup> *The Vera Cruz* (No. 2), 1884, 9, 88 at 101. (Death; No right of action.) [*con. of acc.*, p. 15]
- <sup>42</sup> *United Collieries v. Hendry*, 1909, A.C. 383; 2 B.W.C.C., 308. (Survival of rights of deceased workman to his personal-representative.) [*con. of acc.*, 17.]
- <sup>43</sup> *Warnock v. The Glasgow Iron and Steel Company*, 41 S.L.R., 359; 6 F., 474. (That injury caused death is a fact.) [*c.g.*, Death, 922.]
- <sup>44</sup> *Williams v. The Mersey Docks*, 1905, 1 K.B., 804. (Death; Rights barred by Public Authorities Protection Act.) [*c.g.*, Death, 915.]
- <sup>45</sup> *Williams v. The Vauxhall Colliery*, 1907, 2 K.B., 433; 9 W.C.C., 120. (Rights of dependants are distinct from those of deceased workman.) [*con. of acc.*, 17.]
- <sup>46</sup> *Wilson v. Finch Hatton*, 1877, 2 Ex. Div., 336. (Defective sewers in furnished houses.) [*c.g.*, Infection, 969.]
- <sup>47</sup> *Wren v. Holt*, 1903, 1 K.B., 610. (Arsenic in beer.) [*c.g.*, Poisons—Arsenic, 1040.]
- <sup>48</sup> *Ystradowen Colliery Company v. Griffiths*, 1909, 2 K.B., 533; 2 B.W.C.C., 357. [*c.g.*, Lung, 991.]

## DISEASE.

When disease, whether due to accident or not, is the subject of a claim for compensation or damages, it presents two aspects:

(i.) **Legal.**—The law relating to actions for compensation for damages due to disease.

This is discussed in the sections on Accident and Consequences of Accident, or, if there be any special feature connecting the disease with occupation, in the section on Occupation Disease.

(ii.) **Medico-Legal.**—There are three kinds of diseased conditions which may be material in assessing damages or awarding compensation:

- (a) Diseases arising from the injury, without which they would not have occurred.
- (b) Diseases existing before the injury and aggravating its effects.
- (c) Diseases in Schedule 3 of the W.C.A., 1906 (see below, Occupation Diseases, p. 32g).

(a) **Diseases arising from Injury.**—By this we mean diseased conditions which owe their origin solely to injury.

These diseases fall naturally into two subdivisions, which as a rule are clearly distinct to doctors, but which do not affect the existence of a legal liability, as the person responsible for an injury is responsible for all the natural and reasonable consequences of such injury. But when legal liability is once established, the distinction may be of importance as affecting the assessment of damages by the jury.

The first class is that in which, after the initial injury, no new element is added except the natural processes of repair, growth, etc., which may sometimes be excessive, although they are natural.

The second class is where some new factor which complicates matters is added, either at the time of the injury or after. This class is most commonly represented by infections, either when the injury was made or later.

A link exists between the two classes where the injury or "accident" is the "catching" of a disease, as was either held or alleged to have occurred in Anthrax (Brintons, Ltd., *v.* Turvey,<sup>2</sup> *Higgins v.* Campbell and Harrison<sup>11</sup>) under the W.C.A.; in Ptomaine-Poisoning (*Hands v. Slater*<sup>9</sup>) and Typhoid Fever (*Frost v. The Aylesbury Dairy Company*).<sup>6</sup>

Where no new factor is added, the disease may arise in many ways in consequence of the infliction of an injury—*e.g.*, at the site of the injury, when the vessels of a limb being damaged produce gangrene of the limb by cutting off the blood-supply beyond the injury (see Gangrene); also during healing, as in contractions of the tissues by scars (see Heat, p. 430, and Œsophagus, p. 602); or by overgrowth of callus, which includes and presses on nerves (see Bones, p. 132—Nerves); or even through disturbance of the general nervous system at a distance from the original injury in traumatic neurasthenia, traumatic hysteria, or even in insanity. (See Case Guide: Neurasthenia; and Insanity, pp. 455, 580.)

As has been said, the new element is usually an infection, and this may be either (1) simple and mainly local, such as occurs when a wound "inflames" and discharges for a short time, and then heals; or (2) complicated and general, where the whole body suffers severely from the infection, as in cases of "blood-poisoning"—*e.g.*, pyæmia. (See Infection).

**(b) Disease existing before the Accident and aggravating its Effects.**—This class is of vast importance, as being the most easy condition under which fraudulent claims can be made; it also is divided into two classes, where the injury—

- (i.) Makes the disease worse.
- (ii.) Produces more serious effects on account of the presence of a disease.

(i.) *The Disease is rendered Worse.*—A disease may have been established before the injury, in consequence of which death, or increased incapacity, occurs at a date earlier than would have been anticipated had the injury not happened. In some cases the disease is latent, in others patent. This class of case has very frequently been before the Courts, especially under the W.C.A., and the following cases are more fully discussed under their heads in the Case Guide:

*Appendix*: Rupture of diseased appendix, etc.—*Appel v. Ætna Life Assurance*,<sup>1</sup> and *Brownhill v. The Westminster City Council*.<sup>4</sup>  
*Genital Organs—Female*: Prolapse of womb rendered worse—*Roper v. Greenwood*.<sup>21</sup> *Heart*: Disease rendered worse by enteritis—*Broderick v. L.C.C.*<sup>3</sup> *Joints*: Latent gout stirred into activity—*Lloyd v. Sugg*.<sup>16</sup> *Kidney*: Bright's disease accelerated, causing death—

Golder *v.* The Caledonian Railway,<sup>8</sup> and Marsden *v.* The Huddersfield Corporation.<sup>17</sup> *Lungs*: Tuberculosis accelerated and awakened—Davis *v.* The Point of Ayr Collieries.<sup>5</sup> *Rupture*: Rendered worse by strain—Fulford *v.* The Northfleet Coal Company,<sup>7</sup> and Timmins *v.* The Leeds Forge Company.<sup>22</sup> *Stomach*: Cancer rendered worse—Jones *v.* M'Laren.<sup>14</sup>

(ii.) *The Injury produces more Serious Effects on Account of the Presence of Disease.*—The disease has already reduced the natural resistance of the human body to a low state, so that the effects of a trivial injury may be most severe.

Many, if not all, of the cases of traumatic neurasthenia and traumatic hysteria belong to this class. The patients may be "degenerates," or merely of such weak health that they are pre-disposed to a nervous breakdown after an injury which, to a healthy person, would have been so slight as not to produce any serious result.

The defendant is liable for all the damage resulting from an injury to a person in such a state, and the respondent, under the W.C.A., is similarly liable to pay full compensation.

The position was stated as follows by COLLINS, M.R., in Lloyd *v.* Sugg<sup>16</sup>:

"In the case of a delicate lady receiving a shock in a railway accident, the actual shock would be the same as in the case of a lady in sound health, but the resulting injury would be far greater; in every case the ultimate result differs, according to the physical condition of the person at the time of the accident."

Other examples, in some of which the claims were successful and others not, will be found in the Case Guide—*e.g.*:

*Brain*: Diseased vessels rupture under slight strain—M'Innes *v.* Dunmuir.<sup>18</sup> *Genital Organs*—*Male*: Hæmatocele of diseased testicle after slight injury—Keep *v.* Brown.<sup>15</sup> *Heart Disease*: Valvular disease rendered worse by strain—Rankine *v.* The Alloa Colliery Company.<sup>20</sup> *Heat*: Weakness predisposes to heat-stroke—Ismay, Imrie and Co. *v.* Williamson.<sup>13</sup> *Muscles*: Rupture of fatty muscles under slight strain—Perry *v.* Baker.<sup>19</sup> *Spine*: Locomotor ataxy rendered worse by accident—Willoughby *v.* Great Western Railway.<sup>23</sup> *Stomach*: Rupture of vessel in diseased stomach—Hensey *v.* White.<sup>10</sup> *Vessels*: Aneurism bursts under ordinary strain—Hughes *v.* The Clover Clayton Colliery.<sup>12</sup>

#### CASES.

<sup>1</sup> Appel *v.* Ætna Life Assurance Company, 86 App. Div. Rep., N. York, 83. (Rupture of diseased appendix.) [*e.g.*, Appendix, 879.]

<sup>2</sup> Brintons *v.* Turvey, 1905, A.C., 230; 7 W.C.C., 1. (Anthrax.) [*e.g.*, Anthrax, 877.]

<sup>3</sup> Broderick *v.* L.C.C., 1908, 2 K.B., 807; 1 B.W.C.C., 219. (Heart disease accelerated by sewer-man's enteritis.) [*e.g.*, Intestines, 978.]

<sup>4</sup> Brownhill *v.* Westminster City Council. (Rupture of diseased appendix.) [*e.g.*, Appendix, 879.]

<sup>5</sup> Davis *v.* The Point of Ayr Collieries, 2 B.W.C.C., 157. (Accelerated tuberculosis of lungs.) [*e.g.*, Lungs, 992.]

<sup>6</sup> Frost *v.* The Aylesbury Dairy Company, 1905, 1 K.B., 608. (Typhoid fever from milk.) [*e.g.*, Death, 921.]

<sup>7</sup> Fulford *v.* Northfleet Coal Company, 1 B.W.C.C., 222. (Aggravation of old rupture.) [*e.g.*, Rupture, 1059.]

<sup>8</sup> Golder *v.* The Caledonian Railway, 1903, 5 F., 123. (Kidney disease aggravated by injury.) [*e.g.*, Kidney, 987.]

- <sup>9</sup> *Hands v. Slater.* [*c.g.*, Ptomaine-Poisoning, 1057.]
- <sup>10</sup> *Hensley v. White,* 1899, 16 T.L.R., 64; 2 W.C.C., 1. (Rupture of diseased vessels in stomach.) [*c.g.*, Stomach, 1068.]
- <sup>11</sup> *Higgins v. Campbell and Harrison,* 6 W.C.C., 1. (Anthrax.) [*c.g.*, Anthrax, 877.]
- <sup>12</sup> *Hughes v. Clover, Clayton and Co.,* 25 T.L.R., 760; 2 B.W.C.C., 15. (Rupture of aneurism.) [*c.g.*, Vessels, 1079.]
- <sup>13</sup> *Ismay, Imrie and Co. v. Williamson,* 1908, 24 T.L.R., 881, 42 I.L.T., 7; 1 B.W.C.C., 232. (Heat-stroke.) [*c.g.*, Heat, 961.]
- <sup>14</sup> *Jones v. M'Laren.* (Injury to diseased stomach, cancer.) [*c.g.*, Stomach, 1068.]
- <sup>15</sup> *Keep v. Brown.* (Injury to diseased testicle.) [*c.g.*, Genital Organs—Male, 949.]
- <sup>16</sup> *Lloyd v. Sugg,* 1900, 16 T.L.R., 65; 2 W.C.C., 5. (Gout aggravated by injury.) [*c.g.*, Joints, 984.]
- <sup>17</sup> *Marsden v. Huddersfield Corporation.* (Kidney disease aggravated by injury.) [*c.g.*, Kidney, 987.]
- <sup>18</sup> *M'Innes v. Dunmuir,* 1908, 45 S.L.R., 804; 1 B.W.C.C., 226. (Rupture of diseased vessels in brain.) [*c.g.*, Brain, 896.]
- <sup>19</sup> *Perry v. Baker,* 1901, 111 L.T.J., 209; 3 W.C.C., 29. (Rupture of degenerated muscles.) [*c.g.*, Muscles, 1023.]
- <sup>20</sup> *Rankine v. The Alloa Coal Company,* 1904, 6 F., 375. (Heart disease aggravated.) [*c.g.*, Heart, 958.]
- <sup>21</sup> *Roper v. Greenwood,* 83 L.T., 471; 3 W.C.C., 23. (Prolapse of the womb made worse.) [*c.g.*, Genital Organs—Female, 945.]
- <sup>22</sup> *Timmins v. The Leeds Forge Company, Ltd.,* 1899, 16 T.L.R., 521; 2 W.C.C., 10 (Aggravation of old rupture.) [*c.g.*, Rupture, 1060.]
- <sup>23</sup> *Willoughby v. The Great Western Railway Company,* 1904, 117 L.T.J., 132; 6 W.C.C., 28. (Spinal disease aggravated.) [*c.g.*, Spine, 1067.]

## OPERATION.

### Treatment.

Where one person sustains injury for which he alleges that another is liable, and commences proceedings against that person, the position may be materially altered by the action of the injured party in having submitted or refused to submit to medical or surgical treatment of the injury.

This question has frequently been before the Court in connection with claims under an insurance policy, in actions for negligence, and in arbitrations under the Workmen's Compensation Act; but, unless special restricting words in the insurance policy modify the position, the legal principles involved are the same in each case.

The position of the litigants will be discussed in two subsections:

1. The rights, duties, and liabilities, of the defendant (including respondent under the W.C.A.).
2. The rights, duties, and liabilities, of the plaintiff (including applicant under the W.C.A.).

**1. The Rights, Duties, and Liabilities, of the Defendant.**—If the injured party follows the instructions of his own properly qualified medical man, he has done all that can be required of him, and the other party may be liable, in an action for damages, for all the consequences which may reasonably be held to be the result of the injury. It has been already mentioned that, under the Workmen's Compensation Act, the employer is not liable for such expenses as surgical treatment, nursing, funeral, etc., of the workman (see above, pp. 16-17).\*

\* Except sometimes in case of partial dependants (*Bevan v. Crawshaw Brothers* [1902], 1 K.B. 25, 4 W.C.C. 110; *Sulleman v. Ben Lomond*, County Court 125 L.T.J., 305), or where a workman leaves no dependants at all.



The unreasonable refusal of the injured workman to submit to proper treatment may lessen, suspend, or even terminate, the liability of the employer to pay compensation under the Workmen's Compensation Act. The burden of proof that such refusal is unreasonable is upon the employer (*Tutton v. Owners of s.s. Majestic*,<sup>19</sup>), and the Irish Court of Appeal has even held that such a contention cannot be set up at an original arbitration, but only on an application for review (*O'Neil v. Ropner*<sup>9</sup>).

The exact extent to which the refusal or neglect to submit to correct treatment is a defence in actions for damages is not so clear, and we have not been able to find a recorded case where the question has been decided in an action for personal injuries, but the principle is undoubted.

In an American case this defence was set up in answer to a claim for damages resulting from death. It was ascertained that, in spite of the advice of his doctor, the deceased man at first refused to have his injured leg amputated. The operation was eventually performed, but it was too late, and the man died. It was unsuccessfully pleaded that had the amputation been performed in time his life would have been saved; the principle was admitted, but the facts did not bring the case within it (*Sullivan v. The Tioga Railroad Company*<sup>16</sup>).

It may happen that, although the workman has followed proper medical advice, serious consequences result from his submitting to the prescribed treatment; in such a case the liability of the employer under the W.C.A. may be considerably increased.

For example, if an operation is performed and is unsuccessful, then, provided that such an operation was a reasonable one, any increased incapacity, or even death itself, may be held to be the result of the original accident. This is illustrated by the case of *Shirt v. The Calico Printers' Association, Ltd.*,<sup>14</sup> where the workman, having successfully gone through an operation immediately after the accident, at a later date underwent a further and comparatively slight operation, which was necessary for complete cure. He died under the anæsthetic administered in the second operation, and the death was held to be a consequence of the original accident, for which the master was liable. Had the second operation been performed for a malady unconnected with the original accident, the decision would have been different (*Charles v. Walker*<sup>2</sup>).

Again, the operation must be reasonable; and, although we have not been able to find any report of an action dealing with personal injuries, yet from the analogy of actions for breach of contract, it is clear on principle that the defendant would not be held liable for unfortunate consequences of a speculative operation.

**2. The Rights, Duties, and Liabilities, of the Plaintiff.**—It is a well-established principle that, where a man suffers damages, there is a duty upon him towards the defendant to minimize his loss. It is a proper question to be left to the jury to decide whether or not the damages given to the injured plaintiff are to be reduced or not in consequence of his conduct after the accident.

We have not succeeded in finding any reported case of personal injuries, outside the Workmen's Compensation Act, in which this

question has been before the Court, but the principle has long been established in cases of tort or breach of contract (*Roper v. Johnson*,<sup>11</sup> *Frost v. Knight*,<sup>5</sup> and *Wilson v. Hicks*<sup>21</sup>). Under the Workmen's Compensation Act, however, the matter has recently been before the Courts, and the dictum of Fletcher Moulton, L.J., in *Warncken v. Richard Moreland*,<sup>20</sup> "A workman must behave reasonably," seems exactly to express the duty of the injured workman. What is "reasonable" conduct will depend on many considerations. By analogy to breach of contract, although the plaintiff is bound to minimize his loss, he is not called upon to add to his own responsibilities by speculative acts, in the hope of reducing his loss, for the benefit of the defendant (*Frost v. Knight*<sup>5</sup>). We may conclude, therefore, that no injured person would be called upon to undergo any operative or other treatment which was speculative in its results. This is indicated in *Marshall v. The Orient Steam Navigation Company*,<sup>8</sup> in which it was decided that the employer has to prove that an injured workman is likely to benefit by the performed operation before it can be held that the refusal is unreasonable.

Further, an injured man need not employ a surgeon of more than ordinary skill, but must act reasonably and in good faith. If he so act, he will not be disentitled to recover, owing to the mistakes of his surgeon; but he is not likely to be able to recover damages caused by the deliberate employment of a man known to be unqualified (*Lyons v. Erie Railway*<sup>7</sup>).

As has been already mentioned, the whole of this matter has been specially considered recently in compensation cases; and, though the principle is the same whether the claim be under the Workmen's Compensation Act or otherwise, the following illustrations are drawn entirely from the cases decided under that Act. The question has been decided under three separate and totally different sets of conditions. As we have said, it is a condition precedent that the master shows that the projected treatment will most probably cure the patient (*Marshall v. The Orient Steam Navigation Company*<sup>8</sup> and *Hawkes v. Richard Coles*<sup>6a</sup>). The onus of this is upon the master, but once it be proved, the position depends upon the grounds upon which the man's refusal was based. The refusal may be—

- (1) In the face of the advice of his own doctor.
- (2) Under the advice of his own doctor.
- (3) Without reference to any doctor.

(1) **The Refusal is in Face of the Advice of his Own Doctor.**—The English and Scotch decisions at one time appeared to conflict as to the legal consequences which attached to the unreasonable refusal of a workman to undergo an operation. It appeared from the earlier reports that, though the Scottish Courts held that a man should submit to any necessary treatment, yet, on the authority of *Rothwell v. Davies*,<sup>12</sup> whether a man's refusal was reasonable or not, no such compulsion would be suggested by the English Courts.

That judgment governed, in England, the position of employers whose injured workman refused to submit to operative treatment.

Davies injured his hand, and eighteen months after, when it was

healed, refused to have it operated upon; the employers applied for a review, and the arbitrator, acting on the evidence before him, refused to reduce the amount of compensation. The Court of Appeal upheld the award of the arbitrator, Collins, M.R., quoting and laying weight upon the following evidence given by Dr. Floyd in opposing the suggested operation:

“It might be a risk to life.”

“I would not on any account have this operation performed on me were my hand in this state” (Cozens-Hardy, M.R., in *Warncken's case*<sup>20</sup>).

The operation was to deal with a painful spot associated with a small pyramid of bone shown in Plates I. and II.

This case is now not overruled, but explained, by *Warncken v. Richard Moreland and Sons*.<sup>20</sup>

In 1903 the Scottish Courts terminated an award where the injured man had for three years received compensation for injury to his ankle. The man refused to follow simple medical directions, which appeared to have been for passive movements, and in consequence was unable to work. The Courts held that his condition was due to his own neglect.

LORD ADAM said: “I am far from thinking that in every case a workman who has been incapacitated from work by an accident is bound to submit to any medical or surgical treatment that may be proposed, under the penalty, if he refuses, of forfeiting his right to his weekly payments. . . . But that is not the kind of case we have to deal with. . . . The injury was comparatively slight, and the treatment proposed simple and common, and brought within his reach, and the benefit which would have resulted therefrom not doubtful, and I think it was such treatment as any reasonable man would have adopted. I think, therefore, that the present condition of the appellant's ankle is truly due to his own fault and neglect” (*Dowds v. Bennie and Son*<sup>4</sup>).

In another Scottish case, *Donnelly v. Baird*,<sup>3</sup> the following judgment was given. It was afterwards quoted with approval by Farwell, L.J., in his judgment in *Warncken's case*<sup>20</sup>:

LORD M'LAREN: “There is, of course, no question of compelling the party to submit to an operation. The question is, whether a party who declines to undergo what would be described by experts as a reasonable and safe operation is to be considered as a sufferer from the effect of an injury received in the course of his employment, or whether his suffering and consequent inability to work at his trade ought not to be attributed to his voluntary action in declining to avail himself of reasonable surgical treatment.

The leading English case of *Warncken v. Richard Moreland and Sons*,<sup>20</sup> decided in 1909, clearly established the principle that a “workman must behave reasonably,” and submit to an operation where the medical opinion is unanimous as to its safety and advisability. The operation suggested in that case was the removal of a small piece of dead bone which was lying, loosely attached, deep in the tissues of the big toe. The case of *Rothwell v. Davies*<sup>12</sup> was frequently referred to in the course of the argument and judgments.

COZENS-HARDY, M.R.: “I cannot take that case” (*Rothwell v. Davies*<sup>12</sup>) “as lending any support whatever to the suggestion that a

man may decline to submit to a trivial operation not involving any serious risk, but of such a nature that any reasonable man in his own interests would undergo it. I do not understand how anyone can doubt that under the present circumstances the true inference of fact is that the continuance of the incapacity is not due to the original accident, but is due to this workman's unreasonable refusal to take a step which any reasonable man would willingly submit to."

This case has frequently been followed by the Courts, including the Court of Appeal. The judgments are more fully set out in the Case Guide: *Bones, etc.*, pp. 888-892.

One case appears at first sight to contradict this and some of the other judgments, but the Judge's finding of fact really distinguishes it. (*Smith v. Coed Taton Colliery*.<sup>15</sup> See *contra*, Case Guide: *Neurasthenia*, and *Turner v. Brooks and Doxey*<sup>18</sup>.)

(2) **The Refusal is based on Advice of the Man's Own Doctor.**—This is an absolute answer to an allegation of unreasonable refusal to submit to operation, unless it can be shown that the medical man did not give an honest opinion. A single ignorant medical man, if such an individual is to be found, provided he be legally qualified, can give advice against an operation; and if the man says he acted upon that advice, his refusal becomes reasonable, because it is founded upon that one doctor's advice. It is not for the arbitrator to decide the question of reasonableness upon conflicting evidence, or even, it may be presumed, upon a report of the medical referee, whose opinion must be also irrelevant as to the man's reasonableness. The one point is, did the workman act on qualified advice; no matter if the advice be ridiculed by the entire medical profession, and even contradicted by another witness for the workman (*Ruabon Coal Co. v. Thomas*<sup>13</sup>).

The law on this point was finally established in *Tutton v. Owners of s.s. Majestic*,<sup>19</sup> where the employers' doctors desired that a seaman, suffering from rupture, should undergo an operation. For this operation general anæsthesia—*e.g.*, chloroform or ether—was necessary, and the man's own expert witness said that that would be dangerous, as the man had kidney disease. The County Court Judge, after hearing conflicting evidence on this point, decided that the man's refusal was unreasonable, but the award was reversed in the Court of Appeal.

COZENS-HARDY, M.R.: "I think the test is, not whether on the balance of medical opinion the operation might reasonably be performed, but whether the man in refusing to undergo the operation acted unreasonably. I altogether decline to say that in the case of an operation of this kind a man can be said to act unreasonably in following the advice of a competent doctor, even though on the balance of medical evidence given at a subsequent date the County Court Judge might come to the conclusion that the operation was in its nature one which might reasonably and properly be performed."

(3) **The Man's Refusal is not based upon any Medical Advice.**—Under these circumstances the arbitrator has to draw conclusions based upon the evidence given by the employers in favour of the operation, and his own common sense. The following are the principal considerations which have hitherto guided the Courts in deciding whether the refusal is unreasonable or not.

In Sweeney's case<sup>17\*</sup> there was no evidence before the arbitrator that the man based his refusal upon competent medical advice, and the reasons upon which the arbitrator held it to be unreasonable are so sound that they are given here *in extenso* from the reports.

He found that the operation—

“ 1. Is an important minor operation.

“ 2. Is not in the nature of an experiment.

“ 3. Has been attended with complete success in all similar cases (five in number), regarding which evidence is before me.

“ 4. Is not attended with any appreciable risk, the risk of septic mischief (that being the only danger which might arise) being much less than in the case of *Anderson v. Baird*; for in this case I had the advantage of the evidence of the eminent surgeon who advised both in the case just cited and in this case.

“ 5. Will in all probability within two months, or a little longer, restore the applicant the use of his right arm, and enable him to earn wages as before.

“ 6. Is such as a reasonable man, not claiming compensation or damages, would for his own advantage and comfort elect to undergo.”

Other considerations before other Courts have been—

*Anæsthesia.*—General anæsthesia must have been contemplated in *Donnelly's case*,<sup>3</sup> as the operation suggested was excision of the loose head of the radius. Local anæsthesia was clearly intended in all cases where no general anæsthetic was suggested. In a County Court case (*Gilbert v. Fairweather*<sup>6</sup>) before Judge Rentoul, the risk of general anæsthesia was considered, and the doctor *who appeared for the workman* said the risk was very small. Some form of anæsthesia must be contemplated in the operation for the removal of a cataract under the third schedule of the Workmen's Compensation Act. (See below, Statutory Operation.)

In *Rothwell v. Davies*<sup>12</sup> the risk of anæsthesia was discussed. The doctors for the employer, who advised the operation, said ether would be advisable. [As is stated by Dr. Blumfeld, below, on p. 75, the risk of death in the use of that anæsthetic is about 1 in 10,000.] Dr. Floyd for the workman, *Davies*, said: “The risk is small if the wound remains aseptic.” On another occasion, in the same case, he said: “There is no other risk of any importance” (than septic trouble). It may be taken that with sound health the risk of anæsthesia has hitherto been considered to be negligible. In unsound health—for example, in *Bright's disease*—there may be some slight risk. “With kidney disease an anæsthetic would be a risk to life” (*Tutton v. Owners of s.s. Majestic*<sup>19</sup>).

**Statutory Operation.**—From a legal point of view there is one operation which we may call a “statutory” operation, for it is obligatory by statute if full compensation is to be obtained under the W.C.A. The question of reasonableness or unreasonableness does not enter into the case.

By a recent addition made by the Secretary of State to the third schedule of the Workmen's Compensation Act, 1906, compensation

\* It is true that in the Scottish Appellate Court evidence was admitted that the man had had such competent medical advice—that of Professor Annandale of Edinburgh—and on this evidence the finding of the arbitrator was reversed.

is payable for disability from an industrial disease common among glass-blowers, called "glass-blower's cataract"; but this is only payable for four months, unless the man submits to an operation, and then a period of six months in all is allowed for operation, cure, and return to work. The words are as follows:

"A glass-worker suffering from cataract shall be entitled to compensation, under the provisions of the said section as applied by this order, for a period of not longer than six months in all, nor for more than four months unless he has undergone an operation for cataract."

As is mentioned elsewhere, the risk of sepsis, both locally in the eye and spreading from the eye to other parts, cannot be denied, and was doubtless weighed by the Secretary of State when he made the order. Locally there is the very remote risk of infection, causing loss of the eye, and, if extremely unlikely contingent possibilities are to be dragged in, as they so frequently are in the witness-box, the inflammation may spread from the eye to the brain, cause meningitis, and even death. None of these are the least likely to happen, for the operation for the removal of a cataract is carried out daily and successfully in every big eye hospital in the world.

In the following cases the question of refusal has been dealt with:

**Unreasonable Refusal.**—The following operations were held to be of a nature which the man was unreasonable in refusing to undergo:

*Eye.*—Removal of glass-blower's cataract (W.C.A., Schedule III., 1906).

*Finger.*—Amputation of fixed and crooked finger (Anderson *v.* Baird<sup>1</sup>).

*Finger-bone.*—Set crooked, broken and reset. (Hypothetical case suggested by Lord Justice M'Laren in Donnelly *v.* Baird,<sup>3</sup> and adopted by Lord Justice Fletcher Moulton in Warncken *v.* Richard Moreland and Sons.)<sup>20</sup>

*Scar.*—Removal of painful scar (Anderson *v.* Baird<sup>1</sup>).

*Joints.*—Removal of a loose semilunar cartilage of the knee-joint (Gilbert *v.* Fairweather<sup>6</sup>). (County Court.)

*Knee.*—A minor operation on the knee. (Paddington Borough Council *v.* Stack<sup>10</sup>).

**Reasonable Refusal.**—The following have been held to be reasonable refusals:

*Hernia or Rupture.*—Double rupture in a man who had Bright's disease, which rendered general anæsthesia dangerous, and the alternative, spinal anæsthesia, was considered by the medical man as still more dangerous (Tutton *v.* Owners of s.s. *Majestic*<sup>19</sup>).

*Bone: Removal of the Head of the Radius.*—This was Sweeney's case,<sup>17</sup> which has been fully discussed above. The arbitrator held that refusal was unreasonable, and the Appellate Court reversed this decision on proof being given that the man had acted upon Dr. Annandale's advice.

*Small Lump of Bone on the Side of the First Metacarpal Bone.*—Rothwell *v.* Davies<sup>12</sup> (Plates I. and II.).

In each of the medical sections of this book, the need for operation after an accident, and the risk run by the patient, is considered, and in each case an authoritative opinion has been expressed

as to the "serious" nature of the operation. Many operations formerly regarded as most serious are now performed so frequently and successfully that they can no longer be considered as serious or at all speculative. During the writing of this book two of the contributors suffered from appendicitis, and both were successfully operated upon; both were consultants who knew exactly what risk they were undertaking.

## CASES.

- <sup>1</sup> *Anderson v. Baird*, 1903, 5 F., 373 (Scottish). (Unreasonable refusal of amputation of finger.) [Operation, 30.]
- <sup>2</sup> *Charles v. Walker*, 25 T.L.R., 609; 2 B.W.C.C., 5. (Death from operation unconnected with accident.) [*c.g.*, Teeth, 1069.]
- <sup>3</sup> *Donnelly v. Baird*, 1903, S.C., 536; 45 S.L.R., 394; 1 B.W.C.C., 95. (Unreasonable refusal of amputation of second finger.) [*c.g.*, Amputation, 875; Bones, 891.]
- <sup>4</sup> *Dowds v. Bennie*, 1903, 5 F., 268 (Scottish). (Unreasonable refusal of passive movements.) [*c.g.*, Joints, 985.]
- <sup>5</sup> *Frost v. Knight*, L.R., 7, Ex., 111. (Plaintiff must minimize his loss.) [Operation, 26.]
- <sup>6</sup> *Gilbert v. Fairweather*, 1 B.W.C.C., 349. (Unreasonable refusal of operation on knee.) [*c.g.*, Joints, 985.]
- <sup>6a</sup> *Hawkes v. Richard Coles*, 3 B.W.C.C., 163. [*c.g.*, Brain, 898.]
- <sup>7</sup> *Lyons v. The Erie Railway*, 57 N.Y.R., 489, 491. (Employment of unqualified man.) [Operation, 26.]
- <sup>8</sup> *Marshall v. Orient Steam Navigation Company*, 3 B.W.C.C., 15. (Employer must prove operation will cure.) [Operation, 26.]
- <sup>9</sup> *O'Neil v. Ropner*, 43 I.L.T., 3; 2 B.W.C.C., 334 (Irish). (Unreasonable refusal can only be considered on a review.) [Operation, 25.]
- <sup>10</sup> *Paddington Borough Council v. Stack*, 2 B.W.C.C., 402. (Unreasonable refusal.) [Joints, p. 986.]
- <sup>11</sup> *Roper v. Johnson*, L.R., 8 C.P., 167. (Plaintiff must minimize his loss.) [Operation, 25.]
- <sup>12</sup> *Rothwell v. Davies*, 19 T.L.R., 423; 4 W.C.C., 141. (Reasonable refusal.) [*c.g.*, Bones, 891.]
- <sup>13</sup> *Ruabon Coal Co. v. Thomas*, 3 B.W.C.C., 32. [*c.g.*, Rupture, 1060.]
- <sup>14</sup> *Shirt v. Calico Printers' Association*, 1909, 2 K.B., 51; 2 B.W.C.C., 342. (Defendant responsible for death under anæsthesia.) [*c.g.*, Anæsthetics, 875.]
- <sup>15</sup> *Smith v. Coed Taton Colliery Co.*, 2 W.C.C., 121. (Reasonable refusal of treatment.) [*c.g.*, Bones, 888.]
- <sup>16</sup> *Sullivan v. Tioga Railroad*, 112 N.Y., 643, at 648; 8 Am. St. Rep., 793. (Refusal of operation.) (Insurance.) [Operation, 25.]
- <sup>17</sup> *Sweeney v. Pumpherston Oil Company*, 1903, 5 F., 972; 40 S.L.R., 721 (Scottish). (Reasonable refusal of operation.) [Operation, 29.]
- <sup>18</sup> *Turner v. Brooks and Doxey*, 3 B.W.C.C., 22. (Unreasonable conduct in not working.) [Operation, 28.]
- <sup>19</sup> *Tutton v. Owners of s.s. Majestic*, 2 B.W.C.C., 346. (Reasonable refusal.) [*c.g.*, Kidney, 988; Rupture, 1060.]
- <sup>20</sup> *Warncken v. Richard Moreland* (1909), 1 K.B., 184; 25 T.L.R., 129; 2 B.W.C.C., 359. (Unreasonable refusal.) [*c.g.*, Bones, 891.]
- <sup>21</sup> *Wilson v. Hicks*, 26 L.J., Ex., 242. (Unreasonable conduct of plaintiff's agent increasing damages.) [Operation, 25.]

## CURE AND RETURN TO WORK.

The reasons for separating these two subjects in the medical part of this book do not apply to the legal considerations, which are here dealt with together in this one section.

The essential point to be determined is the legal bearing of incapacity to work, which is illustrated almost entirely from the Workmen's Compensation Act, as it is mainly under that Act that the importance of the different aspects occurs.

The subject will be dealt with in the following subsections :

- (a) The legal consequences of incapacity :
  - (i.) Total or partial incapacity.
  - (ii.) Redemption of the weekly payments.
- (b) The meaning of "results from the injury" (W.C.A., Schedule 1, [1], b).
- (c) What is incapacity ?
  - Total or partial; patent or latent.
  - Serious and permanent disability.
- (d) Variation of the amount of compensation :
  - Alteration or review of an award.
  - Termination as from a past, present, or future date.

**Claims under an Insurance Policy, or for Damages for Negligence or Breach of Contract.**—The probability of complete or incomplete cure is one of the matters upon which the jury, after hearing the evidence, assess the amount of damages which they give to an injured person. Consequences of imperfect cure, such as loss of promotion, may be taken into consideration, as they have been held not to be too remote, and may be the natural and probable results of injury; but, as in other cases, the amount, when once assessed, cannot be altered except by an Appellate Court.

(a) **The Legal Consequences of Incapacity.**—"Where total or partial incapacity for work results from the injury." This sentence, in simple words, sets out the sole grounds of a claim for compensation by an injured workman under the Act. The amount of compensation must not in any case exceed £1 per week, but with this restriction it is to be "a weekly payment during the incapacity not exceeding 50 per cent. of his average weekly earnings, and, in the case of a minor earning less than £1 per week, full wages, but not more than 10s." (W.C.A., Schedule 1, [1], b, and the proviso).

Nothing is given to the injured workman for pain and suffering or his medical expenses (*Irons v. Davis and Timmins*<sup>12</sup>), or for his loss of chances of promotion (*Pomphrey v. The Southwark Press*<sup>20</sup>), though, again, in the case of a minor, his prospects may be considered on an application to review, and his compensation may be increased to £1 per week (W.C.A., Schedule 1, [16]).

As a set-off against these disadvantages, a permanently disabled workman has a pension for life, amounting possibly to half his weekly earnings. Subject to what is said below concerning redemption of these weekly payments, the master, and after his death his personal representatives, are liable for this weekly payment as long as the man lives and is incapable. Even after the death of the workman, his dependants may still be able to claim something, unless the workman has already been paid, in the total amount of weekly payments, or by a lump sum in redemption, as much as the dependants would have received had the workman been killed immediately by the accident. The dependants' rights are separate from those of the workman (*O'Keefe v. Lovatt*<sup>17</sup>).

When once the amount of compensation has been fixed and recorded by the Court, whether by registered agreement or by award,

\* See p. 17 for claim by partial dependants for medical attendance.



it becomes a judgment of the Court, upon which execution can be levied for each weekly payment, if it is in arrears. The man may have recovered and be back at full work, but, until the Court alters the amount of compensation, the master is liable, though he can, of course, apply at any time for a review.

*Redemption.*—The weekly compensation, whether the disability is total or partial, permanent or temporary, can be redeemed by the payment of a lump sum; but, as has been mentioned above, though this releases the workman's rights against the master, it may not act as a release of the separate rights of the dependants. This can be done by agreement, which, to be binding, has to be registered by the Court on the application of the employer, but not of the workman (W.C.A., Schedule 2, [9, 10]). If the incapacity is total and permanent, the method of calculation is found in the Act, which states that it is to be a sum proportional to the man's age, and such as would, "if invested in the purchase of an immediate life annuity from the National Debt Commissioners through the Post-Office Savings Bank, purchase an annuity for the workman equal to 75 per cent. of the annual value of the weekly payment" (W.C.A., Schedule 1, [17]).

This calculation presents no difficulty in the case of total permanent disablement, though it entitles the injured man to a far greater amount than he could probably have recovered as damages in an action for negligence, or under the Employers' Liability Act; but partial disability does present a difficulty. To make the agreement binding, the amount agreed has to be mentioned in a registered memorandum. For the registration of the memorandum, application must be made to the Registrar, who may refuse to register it on the grounds of "the inadequacy of the sum or amount, or by reason of the agreement having been obtained by fraud, or undue influence, or other improper means." He may then refer the matter to the Judge, for whose guidance the Act, unfortunately, gives no rule as to what sum is to be considered adequate, and consequently the various County Court Judges differ widely on the point (W.C.A., Schedule 2, [9], *d*). The Case Guide gives examples of this, especially under the head of Amputation.

The Court of Appeal has decided that in cases of partial incapacity the amount is not to be calculated as is directed for cases of total incapacity in W.C.A., Schedule 1 (17) (*O'Neill v. The Anglo-American Oil Company, Ltd.*<sup>18</sup>).

It has also been decided that, in accordance with the Act, the Judge "shall take into consideration" any sum already paid under an unregistered agreement (*Horsman v. The Glasgow Navigation Company*<sup>19</sup>).

(*b*) "**Results from the Injury.**"—As long as the effects of the injury remain, and completely or partially prevent the man from being "able to earn" to the same degree as before the accident, so long does the master's liability to pay compensation remain. Even merely physical or psychical effects, such as traumatic hysteria or neurasthenia, are "results of the injury" (*Eaves v. The Blaenclwydach Colliery*<sup>7</sup>).<sup>1</sup>

Other disabling conditions, such as old age (*Jamieson v. The*

Fife Coal Company<sup>13</sup>) or disease (Cleverley *v.* The Gas Light and Coke Company<sup>6</sup>), may supervene and modify the position; but even then, as long as any inability to earn due to the accident remains, the master is liable.

Where such disabilities are present, the onus of proof is on the master to show that no results of the injury in fact remain. If he can prove this, he need no longer pay. This proof has been given successfully in a case of old age (M'Avan *v.* Boase<sup>14</sup>), and a case of disease (Quinn *v.* McCallum<sup>22</sup>). For further notes on this subject, see Consequences of Accident.

The extent of the master's liability may be further affected by the man's own acts or mental state, which may be the real cause of his abstention from work. If the man prolongs his incapacity by "unreasonably refusing" to undergo proper surgical and medical treatment, he introduces a *novus actus* which suspends or ends the master's liability (see above, Operation). Again, if the man has physically recovered, the Court may put an end to his compensation if he declines to work, through unreasonable fear, *e.g.*, of the machine which injured him (Pimms *v.* Pearson,<sup>19</sup> County Court),—through lack of will-power to overcome the muscular pains caused by disuse (Holt *v.* Yates<sup>9</sup>),—intentional exaggeration of symptoms (Price *v.* Burnyeat and Brown<sup>21</sup>),—or where the man has in fact lost his employment through misconduct, and not through the injury (Hill *v.* The Ocean Colliery<sup>8</sup>); *contra*, Clark *v.* Gas Light and Coke Company<sup>5</sup>.

(c) **What is Incapacity to Work?**—Incapacity may be total or partial, patent or latent, and the work may be skilled or unskilled.

As long as a workman, in consequence of an injury, is not "able to earn in some suitable employment or business" (W.C.A., Schedule 1 [3]) as much as he did before, he is suffering from incapacity; but he is not incapacitated merely because he cannot follow his old work. He is "able to earn" even though he be employed at a totally different business under a different master, or is working for himself.

The master is liable provided that the incapacity results from the accident; he remains liable as long as such incapacity exists, whether it be patent or latent.

Total incapacity means complete inability to earn anything under the conditions which are open to the injured workman—*i.e.*, with his old trade experience and new physical condition. In unskilled labour, deformity or mutilation may not create any incapacity at all. In the case of Cammell, Laird and Co. *v.* Platt<sup>2</sup> an unskilled labourer lost the tops of a couple of fingers, and was held by the County Court Judge to have lost all his earning capacity, "because he could not do his old work." This was set aside by the Court of Appeal.

In Scotland a very strong action was taken by the Court of Session, who finally determined all liability of the master in the case of a lad who had lost part of his third finger (Husband *v.* Campbell<sup>11</sup>). As an example of mutilation being not a restriction but even an advantage, Mr. Colam has communicated a case to us in which he appeared, where the applicant, a girl, whose duty was to put iron plates into an oven, actually earned more after the accident than

before, as speed was an important qualification and the loss of a finger enabled her to move the plates into the oven more quickly.

The smallest injury, however, may incapacitate a skilled worker. For example, loss of sensation in the tip of the little finger of the left hand might permanently incapacitate a professional violinist. (There are numerous cases, quoted in the Case Guide under the head of Amputation, dealing with incapacity due to loss of parts of the body, and some contradictory cases under the head of Eye.)

*Patent or Latent Incapacity.*—The incapacity may be patent or latent. It is patent where the disability to work is obvious; it is latent where, although the injured man is actually receiving as much wages as before the accident, yet for some reason he is not really as capable as he appears. The master, out of kindness or guile, may be paying him wages higher than he is worth; but this will not enable the master to say the injured man has not suffered any loss of capacity to earn wages (*Chandler v. Smith*<sup>4</sup>).

Again, the man may really be at present fully capable of and actually earning full wages even at his former work, and yet have a latent incapacity which may at a later date prevent his being able to earn, either by the consequences of the injury recurring, or by his losing his present employment under the old master, and failing to obtain new work in his altered physical condition. (Recurrence is dealt with below, p. 32e). In cases of this kind a nominal award is made to keep alive the workman's right to compensation, and the master's liability (*Tynron v. Morgan*<sup>23</sup>).

*Serious and Permanent Disability.*—Permanent disability has an important legal bearing, as it enables the injured workman to escape the consequences of his "serious and wilful misconduct" (W.C.A., Section 1 (2) [c]).

In each case it is a question of fact whether a particular injury is a serious and permanent disablement; but the disablement has to be serious as well as permanent to avail the workman, and slight mutilation does not necessarily amount to such serious and permanent disability (*Husband v. Campbell*<sup>11</sup>), though loss of two finger tips was held to be in *Hopwood v. Olive and Co.*<sup>9a</sup>

**Variation in the Amount of Compensation.**—Independently of redemption (mentioned above), the weekly payments may be (i.) varied, (ii.) ended. At any time after an award or registered agreement the weekly payment thereunder may be altered by further registered agreement, or an application may be made to the Court for a review (W.C.A., Schedule 1 [16]).

It appeared at one time on the decided cases that it was necessary to allege a "change of circumstances since the last hearing or registration of the agreement." A very slight change was enough, even an "offer of work" having been held by the Court of Appeal to be sufficient. But the Courts have now decided that the only question is the ability of the man to earn at the date mentioned in the application to review, and that there is no estoppel by evidence based on the opinion of experts (see below, Diagnosis, and *Mead v. Lockhart*<sup>15</sup>).

*Termination of Incapacity.*—As from what date can the arbitrator find that the man's incapacity has ceased?

(1) *Present and Past.*—The Scotch Courts have always held that,

on a simple application to review on the ground that "incapacity has ceased," the date to be taken is that of the *hearing* of the application (Allan *v.* Spowart<sup>1</sup>).

The English Court of Appeal held in Morton *v.* Woodward<sup>16</sup> that the arbitrator might decide the question as at the date of the formulation of the dispute—*i.e.*, of the filing of the application to review. In the case of Charing Cross Railway *v.* Boots,<sup>3</sup> the Court held that, in the case of an application on the simple ground that "incapacity has ceased," the arbitrator cannot deal with a date earlier than that of the application, but gave it as their opinion that, if the question of the workman's capacity at an earlier date had been clearly raised in the application, the arbitrator would have had jurisdiction to decide the point.

(2) *In the Future*.—The English Court of Appeal in Baker *v.* Jewell<sup>1a</sup> decided that there is no power in an arbitrator to make an award to the effect that at some date in the future the man's incapacity will diminish or cease. The Scottish Court of Session has long held that this is beyond the power of the arbitrator. In Allan *v.* Spowart,<sup>1</sup> the Sheriff (the arbitrator) on February 27, acted on a report of the medical referee, who advised that the injured workman would be well on the following 31st of March. The case as reported states:

"The medical officer reported that the appellant had sufficiently recovered from the effects of the accident, and was fit for work; but that, as he had not worked since July, 1901 (nearly five years), he should work above ground for the first three months [*i.e.*, till the following 31st of March]. The arbitrator made an award accordingly.

"LORD PRESIDENT DUNEDIN said: 'The Sheriff Substitute pronounced judgment beforehand on a future event. The function of the Sheriff in assessing compensation is to have regard to the man's state at present, and he is not entitled to pronounce judgment beforehand, the validity of which depends on a man's condition at a future date.'"

#### CASES.

<sup>1</sup> Allan *v.* Spowart, 1906, 8 F., 811 (Scottish). (Scottish date of termination of incapacity.) [Cure and return to work, 32d.]

<sup>1a</sup> Baker *v.* Jewell, 3 B.W.C.C. (No power to make an award ending or diminishing at a future date.)

<sup>2</sup> Cammell, Laird and Co. *v.* Platt, 2 B.W.C.C., 368. (Unskilled labour.) [Cure and return to work, 32b.]

<sup>3</sup> Charing Cross Railway *v.* Boots, 1909, 2 K.B., 640; 2 B.W.C.C., 385. (Date of termination of incapacity.) [*c.g.*, Vessels, 1079.]

<sup>4</sup> Chandler *v.* Smith and Son, 1899, 15 T.L.R., 480; 1 W.C.C., 19. (Incapacity and wage-earning.) [Cure and return to work, 32c.]

<sup>5</sup> Clark *v.* Gas Light and Coke Company, 7 W.C.C., 119; 21 T.L.R., 184. (Dismissal for idleness.) [*c.g.*, Amputation, 871.]

<sup>6</sup> Cleverley *v.* Gas Light and Coke Company, 1 B.W.C.C., 82. (Disease following accident.) [*c.g.*, Tumours, 1075.]

<sup>7</sup> Eaves *v.* The Blaenclwydach Colliery, 100 L.T., 747; 2 B.W.C.C., 329. (Neurasthenia caused by accident.) [*c.g.*, Neurasthenia, 1028.]

<sup>8</sup> Hill *v.* The Ocean Colliery, 3 B.W.C.C., 29. (Dismissal for misconduct.) [*c.g.*, Amputation, 871.]

<sup>9</sup> Holt *v.* Yates, 3 B.W.C.C., 75. (Muscular pains from disuse and ability to work.) [*c.g.*, Muscles, 1020.]

<sup>9a</sup> Hopwood *v.* Olive and Co., 3 B.W.C.C., 359.

<sup>10</sup> Horsman *v.* The Glasgow Navigation Company, 3, B.W.C.C., 27. (Money paid under unregistered agreement.) [Cure and return to work, 32a.]

- <sup>11</sup> *Husband v. Campbell*, 1903, 5 F., 1146. (Mutilation and ability to earn.) [*c.g.*, Amputation, 872.]
- <sup>12</sup> *Irons v. Davis and Timmins*, 1899, 2 Q.B., 330; 2 W.C.C., 26. (No special damage under W.C.A.) [Cure and return to work, 32.]
- <sup>13</sup> *Jamieson v. The Fife Coal Company*, 1903, 5 F., 958; 2 B.W.C.C., 228; 46 S.L.R., 73. (Old age.) [*c.g.*, Age, 864.]
- <sup>14</sup> *M'Avan v. Boase*, 1901, 3 F., 1048. (Old age.) [*c.g.*, Age, 863.]
- <sup>15</sup> *Mead v. Lockhart*, 2 B.W.C.C., 148. (No estoppel by medical evidence.) [*c.g.*, Medical Man, 1009.]
- <sup>16</sup> *Morton v. Woodward*, 1902, 2 K.B., 27; 4 W.C.C., 143. [Cure and return to work, 32*d*.]
- <sup>17</sup> *O'Keefe v. Lovatt*, 1901, 19 T.L.R., 37; 4 W.C.C., 109. (Dependants' rights are separate from the injured workman's.) [Cure and return to work, 32.]
- <sup>18</sup> *O'Neill v. The Anglo-American Oil Company*, 2 B.W.C.C., 434. (Lump sum; partial incapacity.) (Cure and return to work, 32*a*.)
- <sup>19</sup> *Pimms v. Pearson*, 1909, 126 L.T.J., 301; 2 B.W.C.C., 489. (Fear of old work.) [*c.g.*, Neurasthenia, 1026.]
- <sup>20</sup> *Pomphrey v. The Southwark Press*, 3 W.C.C., 194. (No compensation for loss of promotion.) (Cure and return to work, 32.)
- <sup>21</sup> *Price v. Burnyeat and Brown*, 2 B.W.C.C., 337. (Exaggeration of symptoms.) [*c.g.*, Malingering, 997.]
- <sup>22</sup> *Quinn v. McCallum*, 1909, S.C., 228; 2 B.W.C.C., 339; 46 S.L.R., 141. (Disease and incapacity.) [*c.g.*, Heart, 959.]
- <sup>23</sup> *Tynron v. Morgan*, 1909, 100 L.T., 641; 2 B.W.C.C., 406. (Open award; earning full wages.) [*c.g.*, Rupture, 1053.]

## RECURRENCE.

The effects of illness, whether directly or indirectly due to an accident, are very varied. After a cure the ultimate effect may be practically nil, the man for all useful purposes being neither better nor worse than he was before the injury. He may even gain the advantage of being rendered immune from further attacks of some infectious disease; the sequelæ of the injury from which he has suffered, or of having his fractured bone so thickened at the site of the injury by oversupply of the healing material that it is rendered stronger than before. But the more usual ultimate result is some permanent weakness, some tendency to give way under a strain that would not have injured a healthy part, and it is this condition which we include in the term "recurrence." Strictly speaking, there is rarely, if ever, such a thing as true spontaneous recurrence. Some added factor, however small, be it microbe or physical strain, must be present to reproduce the original trouble.

**Claims under an Insurance Policy or Actions for Negligence or Breach of Contract.**—The possibility of recurrence should never be overlooked. It must be remembered that when the jury have once assessed the damages no further claim can be made.

**Workmen's Compensation Act.**—The question of recurrence has, to some extent, been dealt with in the last section (Cure and Return to Work). The risk of recurrence in a man capable of continuing full work has frequently been before the Courts, where it was thought that in future he might find difficulty in doing or getting work as the result of the accident.

There is no power to reopen a *final* award, however unjust it may afterwards appear to have been. *Nicholson v. Piper*.<sup>5</sup>

Such cases are now dealt with by the making of a declaration of

liability or suspensory award, which may be increased to a substantial amount if necessary.

LORD TRAYNER: "In cases of that kind the Court may keep the matter open by authorizing a nominal award of compensation" (*Husband v. Campbell*<sup>4</sup>).

FLETCHER MOULTON, L.J.: "Supposing there was an injury which produced incapacity in the winter, but in the summer, when the weather was fairly warm, the man could work as well as he did before; but in cold weather he was wholly or partially incapacitated, and the employers apply in the summer for a review. They are perfectly entitled to have the compensation cut down to a nominal amount at the time, but they are not entitled to have the compensation terminated, because, if once terminated, it cannot be revived again" (*Tynron v. Morgan*<sup>6</sup>).

Under the head of Disease existing before the Accident and aggravating its Effects, we find numerous cases on the borderland of recurrence. These are cases where quiescent disease resulting from an accident becomes active after subsequent accident. The Court then has to decide whether the new state is due to the original accident or to the later one. A good example of the immense importance of the previous condition is the case of *Davis v. Point of Ayr Collieries*,<sup>1</sup> where an injury revived a dormant and apparently cured tuberculosis of the lungs.

Another case, that of *Gallagher v. Crossfield and Co.*,<sup>2</sup> is an instance of conditions which were regarded by the arbitrator as constituting a recurrence of the effects of injury to the eye.

From the injured man's point of view, the importance of "recurrence" rests on the fact that compensation has to be calculated according to the amount the man was earning at the time of the accident.

Compensation that a workman is receiving on account of some previous injury cannot be calculated as part of his earnings at the time of the second accident (*Gough v. Crawshay Brothers*<sup>3</sup>).

If a workman is injured when in receipt of compensation, and the injury is held to be a new accident, he may be a considerable loser. For example, if he is earning £2 per week, and is injured by an accident which causes total incapacity, he receives £1 weekly as compensation. Later on he returns to light work at, say, 12s. weekly, when the arbitrator might reduce the £1 compensation to 10s. (This, within limits, is purely discretionary with the arbitrator.) The man soon after suffers from a disabling condition held to be a recurrence, and, being totally disabled by his old injury, he has once again £1 a week. If, however, instead of a recurrence, it were held to be a new accident, his latest earnings (12s. a week) alone could be considered, and he would get 6s. compensation for the new accident, with 10s. from the first—16s. per week in all.

Recurrence may sometimes be produced by what is tantamount to fraud. Some men can voluntarily dislocate their lower jaw; this might cause temporary suspension from work in some occupations, such as that of a glass-blower or a bandsman who blew a wind instrument. A rupture also, though it may be efficiently kept up by a truss, is easily reproduced; the possessor has only to discard the truss and cough violently when standing up, or when performing the necessary functions of the body, and the rupture

will reappear without much difficulty. If the man can convince the Court that this happened when at work, there are all the elements of an "accident." Naturally, as in so many of these cases, where all the chief evidence has been throughout in the possession and control of the workman, proof of this fraud is exceedingly difficult to obtain.

## CASES.

- <sup>1</sup> *Davis v. Point of Ayr Collieries*, 2 B.W.C.C., 157. [*c.g.*, Lungs, 992.]
- <sup>2</sup> *Gallagher v. Crossfield and Co.* (unreported; Court of Appeal list for March 30 and May 21, 1909). (Recurrence of injury to eye.) [*c.g.*, Eye, 944.]
- <sup>3</sup> *Gough v. Crawshay Brothers*, 1908, K.B., 441; 1 B.W.C.C., 375. [Recurrence, 32*f.*]
- <sup>4</sup> *Husband v. Campbell*, 1903, 5 F., 1146. (Open award for latent incapacity.) [*c.g.*, Amputation, 372.]
- <sup>5</sup> *Nicholson v. Piper*, 1907, A.C., 215; 9 W.C.C., 123. (No power to open a final award.) [Recurrence, 32*e.*]
- <sup>6</sup> *Tynron v. Morgan*, 100 L.T., 461; 2 B.W.C.C., 406. (Recurrence and open award.) [*c.g.*, Rupture, 1053.]

## OCCUPATION DISEASE.

An occupation disease is a disease caused by the conditions under which a workman carries on his trade or work. In many cases an occupation disease is not an accident in the ordinary and popular meaning of the word, although some cases of such disease have been held to be accidents or the result of accidents; while others, by being included in the third schedule of the Workmen's Compensation Act, are now to be regarded as accidents. An occupation disease may also, under certain conditions, give a right of action for negligence or breach of a statutory duty.

1. **The Factory Acts.**—The Factory Acts are penal, and do not directly confer a right of action for damages, so complete reference to all the legislation dealing with labour in factories is unnecessary here. A breach of the Factory Acts may give rise to—

(a) *A Prosecution before the Magistrates.*—Here a fine is inflicted on the master, which at the discretion of the Secretary of State may be given to the injured man. The receipt of such sum by the workman is not to be taken into consideration in estimating the compensation under the W.C.A., 1906, Section 1 (5), but had to be considered when a claim was made under the W.C.A., 1897, or the Employers' Liability Act, 1880, Section 5.

(b) *An Action for Damages at Common Law.*—In an action for damages caused by conditions which are proved to have been a breach of the Factory Acts, or of rules made thereunder, the master cannot set up the defence of common employment. This was decided in *Bett v. Dalmeny Oil Company*.<sup>1</sup> Further, such a breach gives a right of action for damages without proof of negligence.

RIGBY, L.J.: "Where an absolute duty is imposed upon a person by statute, it is not necessary, in order to make him liable for breach of duty, to show negligence. Whether there be negligence or not, he is responsible *quacunqve via* for non-performance of the duty" (*Groves v. Lord Wimborne*).<sup>5</sup>

2. **The Occupation Disease may itself be "an Accident."**—This is fully discussed above in the section on Disease (p. 22). Here, for an example, we may just refer to the classic case of *Brintons*,

Ltd., *v. Turvey*,<sup>2</sup> where the contracting of anthrax was held to be an accident within the meaning of the W.C.A., 1897. Even where the diseases discussed in the next section are caught by a workman, he can still claim for an "accident" under the Act, if for any reason the necessary conditions to making a claim under the third schedule and Section 8 do not happen to be present. This right is expressly reserved by Section 8 (10).

An unscheduled disease may or may not be an accident when it is a direct consequence of an occupation. Heatstroke in a stoker in an engine-room was held to be an accident by the House of Lords (*Ismay, Imrie and Co. v. Williamson*,<sup>7</sup> while sewer-man's enteritis was held by the Court of Appeal not to be an accident (*Broderick v. London County Council*).<sup>3</sup> In the opinion of some lawyers, *Ismay, Imrie and Co.* overruled *Broderick's* case, but the Court of Appeal in *Eke v. Hart Dyke*<sup>4a</sup> upheld their earlier decision.

A gradual disease is not an accident (*Steel v. Cammel, Laird and Co.*,<sup>8</sup> and *Walker v. Hockney Brothers*<sup>10</sup>).

**3. The Diseases included in Schedule 3 of the Act of 1906.**—The third schedule, with its most recent additions by the Home Secretary, is set out in full in the Appendix.

The following are the conditions precedent to the Recovery of Compensation for Scheduled Disease.

(a) *A Living Workman.*—Where a living workman is certified by the certifying surgeon for the district in which the workman is employed to be suffering from a scheduled disease or its sequelæ, or is suspended under the Factory Acts or its rules on account of such disease, the date given by the surgeon or the date of such certificate or suspension is to be held to be the date of the accident, as if the disease or suspension were a "personal injury by accident."

If both the disease and process are scheduled, a *prima-facie* case in favour of the workman is given by the Act, which will have to be rebutted by the master.

If the disease, but not the process, is set out in the schedule, the workman will have to prove that he caught it from his work; *e.g.*, a certifying surgeon's certificate of anthrax in a workman who was engaged in "handling wool, hair, bristles, hides, and skins," is *prima-facie* proof that the man caught it from his work. The master, to defend himself successfully against such a claim, will have to prove a negative—*i.e.*, that the workman did not catch it from his work. If, on the contrary, this disease was caught by a groom, and he alleged he caught it from his master's horses, he would have to prove that he did so catch it.

It must be noted that the surgeon to certify is the one for the district "in which the man is employed." This has been held to exclude a living sailor from this part of the Act who contracted lead-poisoning at sea (*Curtis v. Black*<sup>4</sup>). As no such proviso appears in the case of death, it would seem that the dependants of a dead seaman might be able to recover.

A certificate of the certifying factory surgeon is essential for the ultimate recovery of compensation, but the Scottish Court of Session held that it need not be obtained or produced until after the commencement of arbitration proceedings (*Taylor v. Burnham*<sup>9</sup>).

(b) *A Deceased Workman.*—The dependants of a deceased workman



can claim for death when they can prove that the industrial disease was the cause of death ; but where the death is alleged to have been due to the sequelæ, it is necessary to prove that the conditions found were in fact the sequelæ of the disease. Where the sequelæ might be due to many causes, one of which is the industrial disease, the onus is upon the applicants to prove that in fact the sequelæ were caused by the disease, not merely that they might have been (Haylett *v.* Vigor<sup>6</sup>).

There are various defences special to claims under Schedule 3 and Section 8 of the Workmen's Compensation Act :

(a) Absence of certificate.

(b) Written misrepresentation of the health of the applicant. Wilful and false representation by the workman, in writing, that he had not previously had such disease (W.C.A., Section 8, [1] iii. b).

(c) Other employers liable. On demand the workman must give the names of all employers during the twelve months previous to disablement. Such employers may be proved responsible for the whole or part of the condition (W.C.A., Section 8, [1] proviso).

(d) Appeal to the medical referee. Either party aggrieved by the giving or withholding of a certificate of disability by the certifying surgeon can appeal to the medical referee (W.C.A., Section 8, [1] f).

#### CASES.

<sup>1</sup> Bett *v.* Dalmeny Oil Company (Scottish) ; 42 S.L.R., 638. (Defence of common employment not available ; breach of statutory duty.) (Occupation Disease, 32g.)

<sup>2</sup> Brintons, Ltd., *v.* Turvey, 1905, A.C., 230 ; 7 W.C.C., 1. (Anthrax.) [*c.g.*, Anthrax, 877.]

<sup>3</sup> Broderick *v.* London County Council, 1908, 24 T.L.R. ; 1 B.W.C.C., 219, 822. (Sewer-man's enteritis.) [*c.g.*, Intestines, 978.]

<sup>4</sup> Curtis *v.* Black, 1 B.W.C.C., 239 ; 78 L.J., K.B., 1022. (Seaman cannot get a certificate of factory surgeon under Section 8.) [*c.g.*, Poison—Lead, 1048.]

<sup>4a</sup> Eke *v.* Hart Dyke, 1910, *Times*, July 13. (Sewer Gas Poisoning.) [*c.g.*, Intestines, 978.]

<sup>5</sup> Groves *v.* Lord Wimborne, 1898, 2 Q.B., 402. (Breach of statutory duty.) (Occupation Disease, 32g.)

<sup>6</sup> Haylett *v.* Vigor, 1908, 24 T.L.R., 885 ; 1 B.W.C.C., 282. (Sequelæ of lead.) [*c.g.*, Kidney, 987.]

<sup>7</sup> Ismay, Imrie and Co. *v.* Williamson, 1908, A.C., 437 ; 1 B.W.C.C., 232, (Heatstroke.) [*c.g.*, Heat, 961.]

<sup>8</sup> Steel *v.* Cammell, Laird and Co., 1905, 2 K.B., 232 ; 7 W.C.C., 9 ; (Gradual disease, lead ; not accident.) [*c.g.*, Poisons—Lead, 1047.]

<sup>9</sup> Taylor *v.* Burnham, 46 S.L.R., 482 ; 2 B.W.C.C., 247. (Certifying surgeon's certificate.) [*c.g.*, Medical Man, 1015.]

<sup>10</sup> Walker *v.* Hockney Brothers, 2 B.W.C.C., 20. (Gradual paralysis due to occupation.) [*c.g.*, Nerves, 1024.]

#### DIAGNOSIS AND PROGNOSIS.

**Diagnosis.**—A diagnosis is the conclusion drawn by an expert as to the presence or absence, in the human body, of certain conditions, such as injury, disease, or abnormality. This conclusion is arrived at by the expert in precisely the same way as an ordinary witness arrives at a conclusion as to the existence of those facts of which he gives evidence. Each witness uses the same process, and from what he sees, hears, feels, tastes, or smells, coupled with his previous experience, training, reasoning, and powers of memory, is able to swear that a fact exists. There is no real difference between

the expert and an ordinary witness except the training. Each is liable to error, and may honestly swear to what he believes to exist, but which in fact does not exist. An expert witness swears that a man has a broken bone or a faulty valve in his heart; an ordinary witness swears he saw a haystack. Both may be wrong; the bone may be dislocated, and not broken; the heart not diseased, but in an anæmic condition; and the haystack may be something else—similar to but not a haystack.

**Prognosis.**—Laymen sometimes confuse prognosis with diagnosis. Prognosis is the conclusion which the medical expert draws from the facts he discovers; it is often a mere skilled conjecture or calculation of chances, or even an intelligent prophecy—a totally different thing from diagnosis. Medical evidence, as a rule, when a judicial decision has once been given which is partly based upon it—cannot be contradicted. The whole subject is *res judicata*; no matter how erroneous or faulty the evidence, nor how ignorant the medical witness, unless the decision be disturbed by an Appellate Court, no contradiction or correction is possible.

There is one exception, and that is an open award under the Workmen's Compensation Act. Here conflicting evidence may be given as to a man's state of health on a particular day, and the Judge, after hearing a full cross-examination, may carefully consider the matter, and come to a definite conclusion resulting in the making of an open award.

In this case the parties are at liberty to apply for a review as to the man's state of health on a subsequent given day; at the hearing all the evidence given on the previous occasion may be repeated or disputed by fresh evidence for the purpose of persuading the Judge to come to a conclusion differing from his former one—although the actual accuracy of the Judge's previous decision cannot be then questioned.

At a review of an open award there is no such thing as estoppel by evidence. The leading case on this point is *Sharman v. Holliday*,<sup>2</sup> which in some respects was a question of *prognosis*; this case was followed by the Court of Appeal in *Mead v. Lockhart*,<sup>1</sup> from which the following judgment is taken, and in which the earlier case is also quoted. The medical evidence was conflicting in each case.

For further notes and the judgments on this subject, see Case Guide: Medical Men, Expert Evidence, p. 1009.

#### CASES.

<sup>1</sup> *Mead v. Lockhart*, 2 B.W.C.C., 398. [*c.g.*, Medical Man, 1009.]

<sup>2</sup> *Sharman v. Holliday*, 1904, 1 K.B., 235; 6 W.C.C., 147. [Diagnosis, 32j.]

### MALINGERING.

As Malingering is the subject of a separate article by Dr. Collie, and a few cases under this head are quoted in the Case Guide, full discussion of the subject is unnecessary here.

Proceedings in the County Court under the Workmen's Compensation Act are "judicial proceedings," and therefore any witness who gives false evidence on a material point may be indicted for perjury. (See Case Guide: Perjury.)

PART II  
EFFECTS OF PERSONAL INJURIES



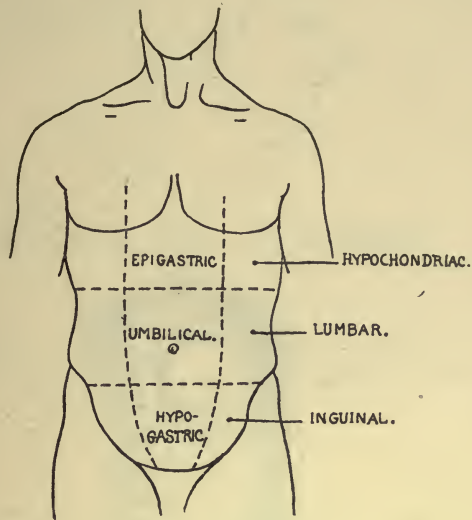


FIG. 1.—ARTIFICIAL DIVISIONS OF THE SURFACE OF THE ABDOMEN.

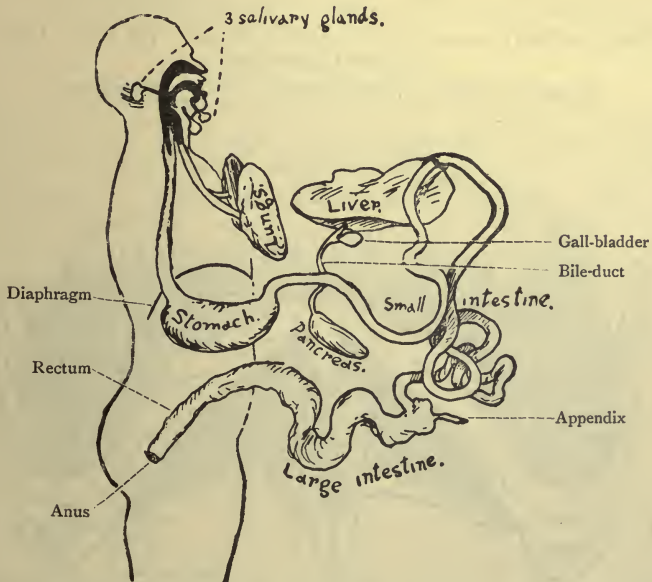


FIG. 2.—SCHEME OF THE LUNGS AND DIGESTIVE TRACT, WITH SALIVARY GLANDS, LIVER, AND PANCREAS.

(From Spourrell's "Elementary Physiology.")

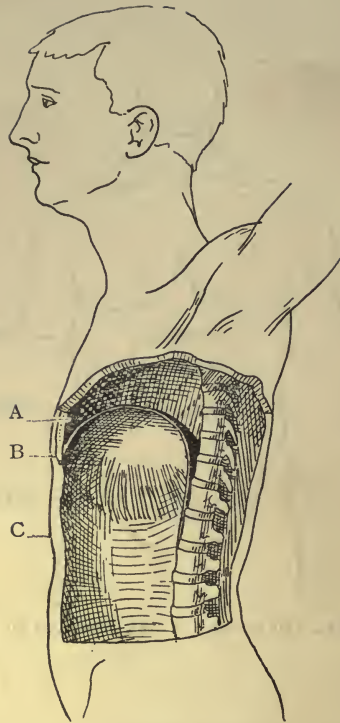


FIG. 3.—BODY EMPTIED OF ITS CONTENTS, TO SHOW THE RIGHT HALF OF THE DIAPHRAGM.

A, Cavity of chest ; B, diaphragm ; C, cavity of abdomen.

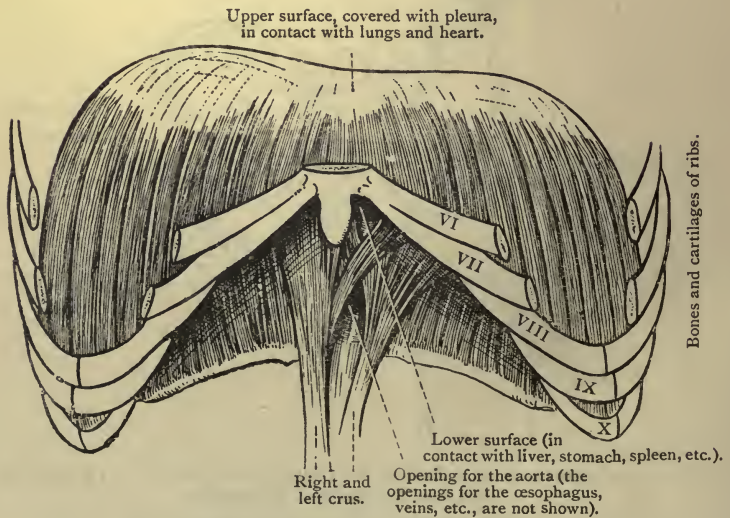


FIG. 4.—THE DIAPHRAGM REMOVED, WITH CUT RIBS ATTACHED.

The numerals VI, VII, VIII, IX, X, are on the cartilages.

(From Buchanan's "Manual of Anatomy.")

# INJURIES TO THE ABDOMEN.

BY JAMES SHERREN,

F. R. C. S.,

Surgeon to the London Hospital ; Surgeon to the Poplar Hospital  
for Accidents ; late Erasmus Wilson Lecturer,  
Royal College of Surgeons.

## Head-note.

THE dangers from accidents to the abdomen are three in number :

1. *Shock.*
2. *Bleeding.*
3. *Inflammation (peritonitis) of the lining membrane.*

## Technical Terms.

*Adhesions.*—Peritoneal adhesions are bands of tissue formed as the result of inflammation in the peritoneal cavity. These may bind one organ to another or to the abdominal wall, and are specially liable to occur in connection with the great omentum. They may give rise to intestinal obstruction, to pain and discomfort, or may interfere with the functions of any of the hollow organs. (See Anatomy of the Peritoneum.) In many cases adhesions cause no symptoms. [Fig. 113.]

*Aorta.*—The chief artery of the body. That portion of it which is contained in the abdomen is called the “abdominal aorta.”

*Appendix.*—A small tube about 3 inches long, with thick walls. Though the thickness is about  $\frac{1}{4}$  inch, the passage is only as big as a crow-quill. It commences where the large intestine joins the small, at the right-hand bottom corner of the abdomen. The other end is loose and blind. It is a relic of the large cul-de-sac of those of the lower animals which eat grass ; the grass, being very slow of digestion, rests in this piece of intestine for some days. [Figs. 2, 9, 10, 11.]

*Band.*—See above, Adhesions.

*Cölon.*—The large intestine, which extends from the right-hand bottom corner of the abdomen, passes up the right side, crosses just

below the liver and stomach, then turns down to the left-hand bottom corner, and ends in the back-passage (anus). [Fig. 9.]

*Diaphragm.*—The muscular partition between the chest and the abdomen. Its contractions are part of the mechanism of breathing. [Figs. 2, 3, 4.]

*Ēpīgāstrīūm.*—One of the nine artificial divisions of the surface of the abdomen. It is placed in the centre just below the breast-bone (the “pit of the stomach”). [Fig. 1.]

*Ligament (in the Abdomen).*—The part of the lining (peritoneum) of the abdomen which leaves the body wall to cover a solid organ, such as the liver. It is merely a narrow strip of tissue composed of a layer of peritoneum at the front and the back, with bloodvessels and a little fat between. (See below, Mesentery.)

*Mēsēntēry.*—The part of the lining (peritoneum) of the abdomen which leaves the body wall to encircle the bowel. The mesentery is a thin membrane (resembling a frog’s foot), the front and back layers of which are peritoneum; the space between contains the vessels of the intestines and a little fat. The line along which it leaves the body wall for the small intestine is about 9 inches in length, and it expands fanwise, so as to cover the intestine, which is 30 feet in length. [Figs. 149, 150, 151, 152, 201.]

*Mēsēntēric Vessels.*—Arteries, veins, and lymphatics, running in that fold of the peritoneum which is called the “mesentery.” They supply the intestines with blood. (See Mesentery.)

*Ōmēntum.*—The folds of peritoneum attached to the stomach. The one attached above is called the “small omentum”; the one below, the “great omentum.” (See Stomach.) [Fig. 172.]

*Pelvis.*—The bony ring which forms the floor and support of the abdomen, the attachment for the legs, and the passage for the lower outlets of the body. [Fig. 202.]

*Pěritōnēum.*—A smooth glistening membrane which resembles that in the interior of the joints, and serves a similar purpose, enabling the organs to glide on each other and on the abdominal wall without friction. This membrane passes from the abdominal wall to surround, partially or completely, the abdominal organs. The folds which it forms in its passage from the abdominal wall to the various organs are given names which differ according to their destination. Thus, a fold of the peritoneum passing to a solid organ, such as the liver, is called a “ligament.” When it passes from the back-wall of the abdomen to the intestine it is called the “mesentery.” The folds passing to the stomach are called “omenta.” (See below, Anatomy and Peritoneum.)

### Anatomy.

The abdomen is that part of the body cavity containing those organs which have to do with digestion, absorption, and



excretion. Its walls are mainly muscular. It is separated from the cavity of the chest by a muscular partition, called the "diaphragm." [Figs. 2, 3, 4.] The abdomen is continued below into the cavity of the pelvis which contains the bladder and the end of the bowel (rectum), together with the womb (uterus) and ovaries in the female. The back-wall of the abdomen is composed of the spinal column and the muscles at each side of it. The side-walls are also composed of muscles, which unite in front. The abdominal cavity is lined by a smooth glistening membrane (the peritoneum) which resembles that found in the interior of joints, and serves a similar purpose, enabling the organs to glide on each other and on the walls without friction. This membrane passes from the abdominal wall to surround, partially or completely, the abdominal organs. (See under Liver, Pancreas, Spleen, Kidney, Stomach, Intestines, etc.) The folds which it forms in its passage from the abdominal wall to the various organs are called by names which differ according to their destination. Thus, a fold of the peritoneum which passes from the abdominal wall to a solid organ, such as the liver or spleen, or from one solid organ to another, as from the kidney to the spleen, receives the name of "ligament." When it passes from the back-wall to the intestine it is called the "mesentery." Those folds of peritoneum passing to the stomach are named "omenta."

The cavity of the <sup>peritoneum</sup> abdomen is the potential space between the layers of peritoneum on the walls and those which cover the organs. During health these layers are in contact. This cavity is divided into two parts, called the "greater" and "lesser" sacs; the lesser sac is a peritoneal cavity between the stomach and its omenta and the posterior abdominal wall. It is of importance in connection with the pancreas. (See Pancreas.) It communicates with the greater sac, which comprises the remainder of the peritoneal cavity, through an opening situated immediately below the liver, termed the "foramen of Winslow."

The peritoneum is of the utmost surgical importance. General inflammation, peritonitis, due to infection with micro-organisms which escape from the alimentary canal or enter from without, rapidly leads to blood-poisoning (septic absorption and septicæmia), and unless it is dealt with by surgical means in its early stages a fatal result ensues. This is owing to the great power of absorption possessed by the membrane.

### Consequences of Accidents.

The principal accidents affecting the abdomen are contusions and wounds of—

- (i.) The abdominal wall.
- (ii.) The muscles.
- (iii.) The peritoneum.
- (iv.) The viscera.
- (v.) The diaphragm.
- (vi.) The bloodvessels. } (See Vessels and
- (vii.) The nerves. } Nerves.)

(i.) **The Abdominal Wall.**—*Contusions.*—The result of direct violence applied to the abdominal wall—blows, crushes, etc.—varies from sudden death, or death in a few hours, to a simple bruising cured in a few days. The position of the injury, the form of violence applied, the condition of the patient, the preparedness of the muscles, the condition of the abdominal organs with regard to distension and health—all these have a bearing. It is often impossible at first to distinguish between a case of a simple contusion of the abdominal wall and an abdominal contusion accompanied by serious internal injury. A blow on the abdomen produces “Shock,” shown by faintness, blanching of the skin, sweating, feeble pulse and respiration, and often by vomiting. In these cases it is only by the most careful watching and examination of the abdomen that the diagnosis of internal injury is made. The rule of the surgeon should be, “When in doubt, operate,” as delay will almost inevitably be fatal if an internal organ has been ruptured. When the injury is to the abdominal wall only, the severe symptoms quickly subside, leaving merely a sense of soreness and bruising. Of the cases of this nature serious enough to be admitted to any hospital as “contused abdomen,” about 75 per cent. will be found to belong to this latter group; in about 15 per cent. there is a serious internal injury requiring operation. In the remainder the signs of a limited inflammation (peritonitis) of the lining of the belly, or of bleeding, disclose some slight degree of internal injury. Contusions of the abdominal wall may be followed by considerable bleeding between the layers of the muscles, and this, unless absorbed, may become infected, leading to the formation of a troublesome abscess.

*Wounds.*—These may be penetrating or non-penetrating; that is, they may pass through the layers of the wall, and either

perforate the lining (peritoneum) of the abdomen or not perforate it. It is only the former that carry any danger to life greater than that from wounds of the soft parts elsewhere (See Wounds.) It is usually impossible to say, until the wound has been explored by the surgeon, into which category it can be placed. In a few cases it is evident, from the protrusion of an organ or the escape of intestinal contents, that the wound has involved all the layers of the abdominal wall.

Wounds of the abdominal wall may divide nerves of sensation or movement (sensory or motor nerves), with resulting loss of sensation or paralysis, with, in paralysis, a tendency to hernia. Wounds in the region of the kidney, whether the result of accident or operation, may lead to an area of tenderness in the loin. This may be very troublesome, and may persist until the nerves are dealt with by operation.

In the majority of penetrating wounds received in civil life, there is no injury to the organs in the abdomen. It is the rule in all wounds of the abdominal wall to examine them carefully under an anæsthetic, and, if the abdomen has been opened, to search for evidence of injury to an organ, and repair it. If the surgeon waits until the symptoms make it evident that internal injury has occurred, it is in many cases too late to operate, as peritonitis will have already commenced.

(ii.) **The Muscles.**—*Contusions.*—Rupture, partial or complete, of one of the long muscles of the front of the belly wall (recti abdominis muscles) may occur as the result of overaction—viz., either by sudden strain, as in over-lifting, or in trying to avoid a blow. It may occasionally be caused by the involuntary contractions during the spasms produced by disease, such as tetanus.

When a patient has received a blow upon the abdomen, resulting in a rupture of muscle-fibre, this is due to a sudden and violent muscular contraction, and not directly to the blow.

In most cases the rupture is partial only, though in any case it may lead to a swelling composed of blood and torn muscle.

*Wounds.*—These are unimportant if slight, but if large and across the fibres of the muscles they may subsequently be the site of a ventral hernia through the scar. (See below, Disease; and Rupture—Ventral Hernia.)

(iii.) **The Peritoneum.**—*Contusions.*—An abdominal contusion occasionally leads to a tearing of the peritoneum. This may cause immediate bleeding of sufficient gravity to require an operation. Or if less severe, may lead to adhesion of one organ

to another organ, to the abdominal wall or to the omentum, with the consequent formation of a "band." This may be followed later by symptoms of varying severity and nature, according to the organ involved. In some cases acute intestinal obstruction may result. (See Peritoneum, p. 617.)

*Wounds.*—In penetrating wounds of the abdominal wall the dangers arise from infection. Apart from this, there is little danger beyond that met with in every wound. In penetrating wounds the apron-like fold of peritoneum (great omentum) from the lower border of the stomach may be involved, and in the resulting inflammation become adherent, forming a band. This may lead to acute intestinal obstruction later, by pressing on the bowel. (See Intestines, p. 473; and Peritoneum, p. 617.)

(iv.) **Internal Organs (the Viscera):—Contusions and Wounds.**  
—In an abdominal contusion with internal injury, the signs consist of continuance of the symptoms of "Shock" detailed above under Contusions of the Abdominal Wall. That is, either the patient, not recovering from the shock, dies, or, surviving for a time, signs of internal bleeding or peritonitis supervene. In some cases it is possible, from the nature of the symptoms or the position of the wound or blow, to determine the organ injured. But this is by no means always the case. In wounds or rupture of the solid organs (see below, Liver, Spleen, Kidney, etc.), the signs are those of internal bleeding. When a hollow organ is wounded or ruptured, the immediate symptoms will depend on the contents of the particular organ injured. If a large amount of irritating fluid is poured out into the cavity of the peritoneum, there is marked shock, which within twenty-four hours is succeeded by the symptoms of peritonitis. In some cases of severe internal injury the initial shock is slight, the patient being able to walk to the doctor or hospital without any discomfort. It is important to remember that absence of pain or shock after the infliction of an abdominal injury does not necessarily mean ~~there is~~ no serious internal damage. Serious symptoms may be (peritonitis) ours.

some slight (most often injured in abdominal contusions are abdominal) wounded in order of frequency: Liver, spleen, between the layered intestines. Others are very rarely injured. may become infecered that rupture of an internal organ may some abscess. slight injury, particularly in cases in

*Wounds.*—These nbeen previously diseased. (See below, that is, they may pass t.

The parts injured, in order of frequency, in penetrating abdominal wounds are as follows: Omentum, small intestine, large intestine, stomach, liver, spleen, bladder.

It must be remembered that a patient may be suddenly seized with abdominal pain and vomiting as the result of any strain—for example, in lifting a heavy weight. This may be followed by death in a few days, unless the cause of the symptoms be dealt with by the surgeon within a few hours. These cases fall into two groups, in which the symptoms are caused either (a) By a sudden infection of the peritoneum, due to many causes, such as the giving way of an ulcer of the stomach, duodenum, or appendix, or from the bursting of any internal abscess (see below, Disease), or (b) By the sudden snaring of a piece of the bowel under a band of an old adhesion, or through the entering of the gut into an artificial sac or pocket such as is formed by adhesion of the bowels; either of these will produce constriction of the bowel and intestinal obstruction.

(v.) **The Diaphragm** (the muscular partition between the chest and the belly).—This may be ruptured when the abdomen is crushed, but is then never injured without other organs being injured too. The diaphragm is sometimes pierced by penetrating wounds. As the result of a wound or rupture to the diaphragm, the stomach may pass upwards into the cavity of the chest through the opening thus made. This is almost invariably a fatal complication.

(vi.) **The Bloodvessels**.—Injury to the abdominal vessels results in bleeding into the belly cavity. Those vessels most often injured are the vein known as the inferior vena cava, the artery called the aorta, and the mesenteric vessels.

(vii.) **The Nerves**.—Sudden death may follow a blow in the pit of the stomach (epigastric region). This is attributed to the sudden stimulation of the nerves (solar plexus) inside the abdomen. The symptoms are those of death from "Shock."

### Disease.

1. **Produced by Accident**.—(i.) *In the Abdominal Wall (Abscess)*.—The blood which is poured out and collects under the skin as the result of a simple contusion of the abdominal wall may become infected, leading to the formation of an abscess. This would require a small operation, to let out the matter (pus). If left too long, however, the matter may force its way between layers of muscles, and necessitate many

openings to drain it off. These circumstances may delay recovery and leave scars, which are weak and liable to stretch and yield on pressure from within, and so permit of a rupture (hernia) being produced.

(ii.) *Muscles (Hernia).*—Any injury which cuts across the fibres of the muscles leaves a weak spot in the abdominal wall after healing. The muscle fibres when thus injured rarely unite without operation, and the space between the severed ends is taken up by a scar which may yield under internal pressure. In consequence a rupture (hernia), or protrusion of some part of an abdominal organ, may occur at the site of the old injury. This is rendered almost inevitable if an abscess should form during healing. (See Rupture—Ventral Hernia.)

(iii.) *The Peritoneum.*—See Peritoneum.

(iv.) *The Viscera (Internal Organs).*—Intestinal obstruction, acute or chronic, may develop in any case in which an organ or the peritoneum is injured.

(v.) *The Diaphragm.*—Nil.

(vi.) *The Bloodvessels.*—See Vessels.

(vii.) *The Nerves.*—See Nerves.

**2. Existing before the Accident and aggravating its Effects.**—In the abdomen, disease which has led to the thinning of the wall of a hollow organ, such as ulceration in the stomach, or to over-distension, as in the bladder, will predispose these organs to become torn when injured by blows, etc.

Relatively slight violence may lead to the rupture of solid organs, such as the spleen or liver, when they are diseased.

Bands and adhesions, the product of old peritoneal inflammation, predispose a man to intestinal obstruction.

See also Appendix, Bladder, Intestines, Liver, Peritoneum, Spleen, Stomach.

### Operation.

(i.) **On the Abdominal Wall.**—*After Contusions.*—These, if not complicated with any internal rupture or bleeding, require no operation. If the blood which has escaped as the result of the bruise becomes infected, forming an abscess, a small operation is necessary.

*After Wounds.*—All wounds require careful cleaning on account of the enormous risk of setting up infection of the abdominal cavity and consequent peritonitis. It is a rule in all cases to examine the wound very thoroughly under an anæsthetic, and, where the wound has opened the abdomen,

to search for evidence of injury to an organ, and at once to repair it if discovered. In the present day this operation is frequently performed, and has become far less serious than it used to be. The risks are known and avoided. It is now (1908) far less dangerous to open an abdomen than it was some years ago to amputate a foot. For instance, a well-known surgeon has done an operation six times for the removal of a living child from the abdomen of the same mother, without any results except that she has had none of the natural exhaustion of a normal labour. One of the greatest proofs of the confidence surgeons have in operations on the abdomen is found in the large number of them who submit to the operation for appendicitis at the hand of their colleagues. They know the danger to be relatively small. Early operation is of great importance in the case of injuries to the abdomen because, if the surgeon waits until the symptoms make it evident that internal injury has occurred, it is, in many cases, too late to operate.

(ii.) **On the Muscles.**—Cut or torn muscles of the abdominal wall should be stitched together. If this is done the scar is unlikely to stretch, and there is little risk of rupture (hernia) occurring. (See above, Disease caused by the Accident.)

(iii.) **The Peritoneum.**—See Peritoneum.

(iv.) **The Viscera (the Internal Organs).**—After injury to the viscera, death is certain in many cases unless an immediate operation is carried out, and even then the abdominal cavity may be already infected by rupture of an organ and pouring out of its contents. Weakness from loss of blood may cause the death of the patient, even where no infection has taken place.

If this operation for injury to the viscera be performed within twelve hours of the accident, the death-rate is not more than 10 per cent. It increases so rapidly that if the operation is postponed for thirty-six hours few recover.

(v.) **The Diaphragm.**—Injury to the diaphragm is usually complicated with injury to other organs. Even if separately injured, operation is usually impracticable. An attempt to repair a rupture of a wound of this muscle may be made by opening up the cavities of chest and abdomen, but the risk is very great.

(vi.) **The Bloodvessels.**—See Vessels.

(vii.) **The Nerves.**—See Nerves.

## Cure.

(i.) **After Injuries to the Abdominal Wall.**—Contusions and wounds, if uncomplicated, leave no incapacity, and a cure results in a few days.

(ii.) **Cure after Injury to the Muscles.**—Wounds of the abdominal wall which do not divide muscles across their fibres nor perforate into the cavity of the abdomen, if kept clean, unite readily and cause no trouble. But if the wounds cross the muscles, then, unless careful union is produced by operation, there is a risk of a hernia occurring through the scar. This risk occurs no matter what is the cause of the scar, whether it be an accidental or an operation wound.

After abdominal operations there is the risk of post-operative hernia to be considered. In operations, not of an emergency nature, provided that no inflammation of the wound occurs during the course of healing, this risk is avoided, *first* by planning the exact position of the opening into the abdominal cavity so that muscles are not divided; and, *secondly*, by careful reunion, after the operation, of the layers of the abdominal wall. But in emergency operations the incision may of necessity have to be made without regard to the risk of hernia.

In some cases the wound has to be kept open for the purpose of treatment; this makes it almost certain that a hernia will develop later.

If the muscle has been only partly torn, the blood will have poured into it as the result of the accident, and formed a distinct swelling. In favourable cases this soon disappears. The muscle tear will be united by scar tissue, and the abdominal wall in three or four weeks will be as sound as it was before the accident.

But when the whole muscle is torn through, cure apart from operation is unusual; a weak scar will be left, which will certainly yield, leading to a rupture (hernia).

(iii.) **After Injury to the Lining (Peritoneum) of Abdomen.**—In a penetrating wound of the abdominal wall the wound will be healed (provided infection has not occurred) in about fourteen days, and the abdominal wall will be sound in six weeks. Infection of the wound may lead to peritonitis, causing the death of the patient, or leading to an illness prolonged for months, or to gradual formation of bands or adhesions which may cause pain or intestinal obstruction later. (See also the following heading and Peritoneum.)



(iv.) **After Injury to the Viscera (Internal Organs).**—After even the most severe abdominal accident requiring an extensive operation, the cure may be complete. Whether it is so or not will depend on several factors. A successful result after the sewing up of the rent in a wounded organ or the stopping of internal hæmorrhage will depend on the shortness of the interval between the accident and the operation. But although the life of the patient be saved, yet he may be more or less disabled for a long period through loss of blood, or on account of loss of function in damaged organs, or from the formation of peritoneal adhesions.

Even in an uncomplicated case, cure may take two or three months.

(v.) **After Injury to the Diaphragm.**—Cure can never be expected to be complete in any case.

(vi.) **After Injury to the Bloodvessels.**—See Vessels.

(vii.) **After Injury to the Nerves.**—See Nerves.

#### Return to Work.

(i.) **After Injury to the Abdominal Wall.**—In the case of contusions of the abdomen without internal injury, complete recovery is usually rapid, and the patient is able, unless complications ensue, to resume work in a few days.

(ii.) **After Injury to the Muscles.**—In the case of wounds of the abdominal wall or muscles, if these heal without trouble, the man can return to work in from four to six weeks. But where rupture (hernia) occurs in consequence of the damage to the abdominal wall, it prevents the man from being able to perform heavy work. (See Rupture—Ventral Hernia.)

(iii.) **After Injury to the Peritoneum and (iv.) the Viscera.**—As regards injuries involving the peritoneum or internal organs, the time at which the patient can return to work depends on four things:

(a) Loss of blood.

(b) Peritonitis leading to the formation of adhesions.

(c) Condition of the abdominal wall.

(d) Condition of the injured organ.

(a) The patient may be more or less disabled for a very long period owing to loss of blood.

(b) Peritoneal inflammation may have led to the gluing together of organs, or to their adhering to the abdominal wall or to adhesions forming between peritoneal folds and the abdo-

minal wall or between two organs. These adhesions may have resulted either from inflammation due to the escape of the contents of some hollow organ after the injury, or from the manipulation necessary in an operation on the contents of the abdomen. Such adhesions may cause acute obstruction of the bowels, resulting in the death of the patient, unless he is relieved by operation.

In other cases the adhesions give rise to pain varying in situation and nature, according to the parts involved. Improvement would here be unlikely to occur apart from operation.

(c) After injury to the abdominal wall, it is to hernia through the yielding scar that inability to do heavy work is usually due. The exact duration cannot be stated. (See above, Cure.)

(d) After perforation of a hollow organ closure of the wound may interfere with functions of the organ and necessitate further operative treatment. After a severe abdominal operation, even under the most favourable circumstances, the patient cannot be expected to be able to resume work before the lapse of three months, and may never be able to resume any work that involves prolonged muscular effort.

(v.) **The Diaphragm.**—If the patient survive operation for rupture or wound of this muscle, the abdomen is left very weak on account of the extensive wound which was necessary.

### Recurrence.

The effects of injury to the abdomen do not tend to recur, except in so far that the scars of wounds or of ruptured muscle may continually tend to yield and so produce hernia.

### Occupation Diseases.

There is no particular occupation in which the abdomen is especially liable to injury producing special effects.

### Diagnosis.

In severe abdominal accidents there is usually no question as to the diagnosis of internal injury, as the symptoms are clear.

In some cases, as in the perforation of an ulcer in the alimentary canal, or the onset of intestinal obstruction due to a strain, there may be grounds for debate as to whether or not either condition is due to the strain or an accident.

In those cases in which pain or discomfort is complained of, following an abdominal injury which appeared not to be severe at the time of its infliction, the closest investigation is necessary

as to the exact seat of the alleged pain or discomfort and the exact time of its occurrence. No rules can be laid down for guidance in these cases. They are of the utmost difficulty, and often nothing more than an opinion can be given that they may or may not have been caused by an injury as alleged.

### The Malingerer.

In the minor cases in which pain is stated to be the result of an abdominal strain or contusion, where no physical signs of disease are present, there is nothing definite that can be laid down. (See above, Diagnosis.) The only cases in which it can be stated positively that an accident is the cause of the symptoms are those in which there is evidence of a wound or contusion of the belly wall, or the signs found at the operation are those which occur only as the result of injury, such as penetrating wounds, ruptures of organs, etc.

### Criminal and Self-inflicted Wounds.

There is no special feature about criminal or self-inflicted wounds.

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*For legal cases of Abdominal Injuries see CASE GUIDE :  
Intestines, Rupture, Stomach, etc.*

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### ACIDS.

*See* POISONS.

### ADULTERANTS IN FOOD.

*See* PRESERVATIVES IN FOOD.

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### AFRICAN BOXWOOD.

*See* POISON — GONIOMA KAMASSI.

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### AIR, COMPRESSED.

FOR EFFECTS OF COMPRESSED AIR, *see* CAISSON DISEASE.

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### AIR-PASSAGES.

*See* LUNGS, THROAT, TRACHEA.

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### AIR-SINUSES.

*See* NOSE.

# ALCOHOL.

By J. FRANK WETHERED,

M.D., F.R.C.P.,

Physician (with care of out-patients) to the Middlesex Hospital, and Lecturer  
on Medical Jurisprudence, Middlesex Hospital Medical School;  
Physician to the Hospital for Consumption and  
Diseases of the Chest, Brompton,

AND

GORDON TAYLOR,

M.A., M.S., B.SC., F.R.C.S.,

Assistant-Surgeon to the Middlesex Hospital.

## Head-note.

THE main relations of alcohol to accident are—

1. That alcohol produces a degenerate condition of the body, so rendering the processes of repair of injury difficult.
2. By its action on the nerves alcohol renders an individual more liable to sustain an accident.
3. By its action on the heart and reduction of the body temperature alcohol renders death more liable to result from injury or operations.
4. Erysipelas and other complications are likely to arise in alcoholic subjects.

## Technical Terms.

*Ascites*.—Dropsy of the abdomen.

*Ankle Clonus*.—A rapidly repeated up-and-down movement of the foot, produced by sharply bending up the toes of the fully extended and stiff leg. It is usually a sign of disease.

*Anæsthësia*.—A condition of insensibility brought about by the administration of an anæsthetic.

*Aortic Valve*.—One of the valves of the heart. (See Heart.)  
[Fig. 100.]

*Athëromata*.—A disease of the arteries, causing a degeneration of their walls.

*Aneurism*.—An abnormal stretching and yielding of the wall of an artery, producing a dilatation in the form of a pouch or swelling.

*Absolute Alcohol.*—A clear white volatile fluid produced by distillation of fermented sugary matters. Absolute alcohol is pure alcohol, without the admixture of any water. This is a chemical curiosity, as what is sold as absolute alcohol always contains about  $\frac{1}{2}$  to 8 per cent. of water. Various forms of diluted alcohol are upon the market in the form of alcoholic beverages. The strength of these is estimated in the amount of absolute or pure alcohol they contain. (See below, Proof and Rectified Spirit.) The alcohol used as a beverage is diluted ethylic alcohol, but there are various forms of alcohol, of which methylic alcohol is one. When some quantity of methyl alcohol is mixed with ethyl alcohol, the mixture is called "methylated spirit."

The following are the percentages of the average amount of alcohol found in the commoner forms of beverage :

				Per Cent.
Beer (English ale)	...	...	...	4 to 7
Brandy	...	...	...	40 to 50
Champagne	...	...	...	10 to 15
Cider	...	...	...	5 to 10
Claret	...	...	...	10
Gin ...	...	...	...	45 to 50
Ginger-beer	...	...	...	2 to 3
Hock	...	..	...	10
Liqueurs	...	...	...	40 to 50
Perry	...	...	...	5 to 10
Port ...	...	...	...	20 to 25
Rum	...	...	...	40 to 50
Sherry	...	...	...	20 to 25
Whisky	...	...	...	45 to 50
Wines (British home-made)	...	...	...	5 to 10

*Blood-Plasma.*—The liquid portion of the blood as opposed to the corpuscles.

*Catarrh.*—Inflammation of the mucous membrane.

*Cirrhōsis of the Liver.*—Hardening of the substance of the liver, commonly caused by alcohol. The first stage is usually enlargement, by the growth of new tissue in the liver, which in the course of time shrinks, and in so doing squeezes the liver substance and produces the second stage, which is one of contraction.

*Cōma.*—Complete unconsciousness and loss of sensibility.

*Disseminate Sclerōsis.*—A disease of the nervous system.

*Ether.*—A very volatile liquid used to produce anæsthesia, and made from alcohol. Occasionally taken in the placé of alcoholic drinks. It rapidly produces a form of intoxication, which soon passes off ; so the ether-drinkers can become intoxicated more than once daily.

*Fæces (Motions).*—The excreta passed from the body by the back-passage.

*General Paralysis of the Insane.*—A disease of the nervous system.

*Methylated Spirit.*—See above, Absolute Alcohol.

*Peripheral.*—Pertaining to the superficial parts of the body.

*Peripheral Neuritis.*—A disease affecting the nerves supplying the superficial parts of the body.

*Proof Spirit.*—Spirit containing 49 per cent. of spirit and 51 per cent. of water.

*Reflexes.*—A term used to designate the course of a certain nervous impulse. Thus, if the leg be sharply struck just below the knee a brisk forward movement follows; this is known as the “knee-jerk.”

*Rectified Spirit.*—Spirit containing 54 per cent. of pure alcohol and 16 per cent. of pure water.

*Stertor.*—Noisy snoring breathing common in some forms of unconsciousness.

*Ūræmia.*—A condition of unconsciousness and convulsions which commonly precedes death from kidney disease. It is caused by the retention in the system of poisons that should be excreted by the kidneys. (See below, Diagnosis.)

### Effects upon the Human Body.

The effects of alcohol depend upon various circumstances and conditions which will be discussed below in the following order :

#### 1. Moderate doses of alcohol :

- (a) The physiological effect of a moderate dose of alcohol.
- (b) Age.
- (c) Exercise.
- (d) Personal idiosyncrasy.
- (e) Habit.
- (f) Sex.
- (g) Dose.
- (h) Absorption and elimination.
- (i) The alcoholic liquors.

#### 2. Excessive doses of alcohol :

- (j) Causation of alcoholism (predisposing and exciting causes).
- (k) Predisposing : hereditary, environment, occupation.
- (l) Exciting : worry, ill-health, pain.

## I. MODERATE DOSES OF ALCOHOL.

The amount of alcohol which is consumed by workers of all kinds and grades, and the effect which it has on the various tissues of the body, render a study of "alcoholism" of the greatest importance in relation to injuries: for not only may an excess of alcohol, whether taken exceptionally or habitually, render an individual more liable to sustain an accident, but the state of the tissues of the body may be so altered by the action of alcohol that any injury may produce upon a chronic alcoholic very different results than on a perfectly normal individual injured in the same manner.

(a) **The Physiological Effect of a Moderate Dose of Alcohol.**—Before discussing the morbid condition known under the term of "alcoholism," it is desirable to briefly consider the "physiological action" of alcohol—that is to say, the effect of alcohol consumed in amounts not prejudicial to health. The effects of alcoholic beverages depend not only on the amount of alcohol which they contain, but also on the presence of other ingredients. It is the combined action of the constituents that produce the phenomena noticed, and hence to employ the word "alcohol" is not strictly accurate, and it is only used for purposes of convenience.

Indeed, very few persons have ever tasted pure alcohol, but that point is of academic rather than of practical interest. The action of alcoholic drinks in moderate quantities varies greatly. Taken generally, the first effect is one of stimulation, followed by depression more or less marked. Experience and experiments both coincide on proving that alcohol enables an individual to perform a larger amount of work for a short time than one who has not taken alcohol; but the "spurt" is of short duration, and the staying power of an abstainer is greater than that of a non-abstainer.

It would be out of place to enter here upon a more prolonged discussion as to the effects of a moderate amount of alcohol, taken as a beverage, upon the tissues and functions of the body. It is well to emphasize, however, that alcohol is a drug, and if consumed in excess a poison, and that large amounts necessarily exert deleterious effects, the duration of which depends upon the quantity taken and upon the length of time during which it was taken, these effects being somewhat modified by factors to be presently considered. Further, it is important to remember that alcohol is one of those drugs which have a

tendency to induce a craving for repetition, and that a condition of chronic alcoholism may easily be induced.

Alcohol has also a cumulative action—that is to say, it is cumulative in its effects: for although the drug itself may be eliminated, its effects upon the body may remain; and if a large quantity be habitually taken, the efficiency and well-being of the individual will assuredly be affected, and in the working classes the wage-earning capacity will certainly be diminished.

(b) **Age** has an effect on the physiological action of alcohol, adults being able to take a larger quantity without harm than young children. In old age, too, alcohol has more effect than in young adults. In the aged, alcohol acts as a narcotic, and so assists in inducing sleep, but at the same time senile decay is accelerated.

(c) **Exercise**.—The amount of exercise taken markedly affects the elimination of alcohol. This may be of importance in respect to an accident, in which it was alleged that the injured person was under the effect of alcohol when he received the injuries. For if it could be proved that after taking the alcohol the individual took a large amount of exercise, it might fairly be argued that the effect of the spirit would have passed off more rapidly than if he had remained at rest (unless he was a confirmed alcoholic), and consequently that the accident was not necessarily the result of a condition brought on by excessive “drinking.”

(d) **Personal idiosyncrasy** has always to be considered when discussing the physiological effects of alcohol. Some individuals are much more influenced by alcohol than others, and a dose that would produce no deleterious effects on one man might make another entirely devoid of self-control; consequently the same amount of liquor consumed by a man without such idiosyncrasy, and by one with such a leaning, would render the latter more liable to accident than the former. The exact quantity consumed, therefore, is not always a safe guide to the results. Past history may be a help in such cases. People who have suffered from previous injuries to the head or from sunstroke, are sometimes unusually susceptible to the action of alcohol. Further, certain individuals of an unstable nervous temperament are easily upset by quantities of alcohol which would have no bad effects upon persons with a sound nervous system.

(e) **Habit** also exercises an effect as to the quantity of alcohol that may be taken without rendering a person “the worse for



drink." A man or woman not accustomed to take alcohol in any form may be profoundly affected by very small quantities, whilst those who are habituated to its use may in some instances consume large quantities without exhibiting any untoward symptoms.

(f) **Sex.**—There are no reliable observations, as far as we are aware, that indicate that sex has any influence on the action of alcohol.

(g) **Physiological Dose.**—What may be considered the exact amount of alcohol that may be taken in one large dose, or in repeated doses extended over a long period of time, without doing harm—in other words, the physiological dose—cannot be exactly stated. As will be seen from the foregoing remarks, several factors are at work, and thus evidence on such a point has to be carefully sifted, more particularly as to the influences above mentioned. The scientific investigations which have been made in regard to the amount of alcohol that may be taken without injurious effect have had no definite result, and, as they have been based largely on the amount of absolute alcohol, the deductions are of little practical value, since, as already said, "alcoholic beverages" contain other constituents in addition to alcohol, and many beverages are impure and freely adulterated. In any given case, therefore, especially if only a single excess is alleged, if possible a careful analysis of a sample of the liquid taken should be made. It may be mentioned, however, that some observers maintain that from 1 to 1½ fluid ounces of absolute alcohol is the amount that can be got rid of from the body in one day. This "physiological standard" must be taken as only approximate, and not exact.

(h) **Absorption and Elimination.**—Alcohol is rapidly absorbed from the intestine, so rapidly, indeed, that none can be found in the fæces, and the urine only yields evidence of it after large quantities have been taken. Chemical tests of this nature would be unreliable in assisting to answer the question as to whether or no an individual has been indulging in alcoholic excess. The rapidity with which alcohol leaves the stomach might occasionally prove of value in legal inquiries if the rate were a constant one. Experiment has shown that it will disappear from the stomach in about three hours. Probably, when taken in the form of beer or wine, 80 to 90 per cent. of the alcohol will have left the stomach within half an hour. No reliable standard, however, can be ascertained, and there would probably be considerable difficulty, owing to the nature of the

facts, in obtaining unanimity of opinion which would render evidence on this point of any value.

(i) **Alcoholic Liquors.**—Alcohol is usually consumed in the form of beer, porter, cider, wines, or spirits. They may be roughly divided into strong and weak alcoholic drinks. Amongst the former may be mentioned brandy, whisky, and rum, containing about 45 per cent. of alcohol by volume. Fortified wines, such as port and sherry, contain 20 to 25 per cent. Champagne, which is slightly fortified, usually has from 10 to 15 per cent. In the second category may be mentioned natural wines, claret, hock, and Italian wines, which contain 10 per cent. ; and beer, in which the percentage is usually from 4 to 7. Cider, perry, and other home-made wines, may contain as much as from 5 to 10 per cent., although some ciders probably contain less.

A few words may be said here in reference to unusual forms of alcoholic drinking, more for the purpose of drawing attention to such morbid cravings than for the forensic value which may be attached to them.

Women more especially have recourse to sal volatile, eau-de-Cologne, or tincture of lavender, in order to satisfy their cravings for the effect of intoxicants. These are generally taken secretly, for their purchase is not likely to give rise to suspicion. In a case formerly under the care of one of us (F. J. W.), a lady, a confirmed inebriate, when placed under circumstances in which she could not obtain alcoholic drinks, was found to have drunk about 4 ounces of sal volatile in a day. Ether is occasionally used when other forms of alcohol cannot be procured. Methylated spirit is sometimes consumed, especially in Ireland.

## 2. EXCESSIVE DOSES OF ALCOHOL.

**Causation of Alcoholism.**—This is a subject which is of more interest to the physician than to the jurist, but certain points should be noted when inquiring as to the alleged intemperance on the part of an individual who has met with an accident. It is convenient to divide the causes of alcoholic excess into two classes :

- (a) Predisposing.
- (b) Exciting.

(a) **Predisposing Causes.**—*Hereditary taint* may be traced in a large proportion of the cases. The maternal influence is said to have the greater effect.

*Environment.*—Sordid surroundings, example, crowded or unhealthy localities, chronic ill-health, and similar circumstances, may all predispose to the acquisition of alcoholic habits. In individuals more happily situated drunkenness is not so frequent.

*Occupation*, too, may have a powerful influence in preventing temptation, or, on the other hand, in presenting probabilities of individuals employed in certain occupations becoming alcoholic. All persons actively taking part in the liquor traffic are notoriously "bad lives," owing to the amount of alcohol consumed; draymen, barmen, and publicans frequently show evidence of alcoholism. In this respect an examination of the urine may be of indirect value. The experience of examiners for life assurance offices goes to show that many publicans, though apparently in excellent health, have albumin in the urine, which in many cases indicates (although it does not absolutely prove) over-indulgence in alcohol. (See below, Occupation Disease.)

(*b*) **Exciting Causes.**—These are numerous, and are often sufficiently obvious. Examples are: Failures and worries in business, domestic troubles, illness or death of relatives, loss of personal reputation, overwork, continued ill-health, especially from painful affections—*e.g.*, neuralgia; these and many other circumstances, inducing a strong desire to "forget," frequently lead to a temporary, and then a permanent, resort to alcoholic drinks, producing the symptoms and effects to be described in the next section.

### Effects of Alcoholic Excess.

1. **Acute Alcoholism.**—*Symptoms.*—After a period varying from a few minutes to several hours, according to the quantity and strength of the alcoholic drink which is taken—a period during which there is often an agreeable physical and intellectual excitement producing a sense of "well-being"—the symptoms set in with confusion of thought, a sense of giddiness, pain in the head, imperfect or double vision, indistinct or stuttering speech, uncertain movements of the limbs, and the walk becomes tottering and stumbling, so that the person easily falls to the ground, especially if struck or pushed. The individual becomes confidential, boastful, egoistical, and often amusing for a time. It is particularly worthy of note that the idea conceived by the brain of the acute alcoholic may be

immediately followed by action; it is enough for him to think, and action at once follows, regardless of consequences.

Brouardel ("Death and Sudden Death," translated by Benham, p. 315) quotes an interesting example of this, in which a man, a chronic alcoholic, threw himself from the top of the Bastille. He fell on to an awning that was spread beneath, and thence to the ground. He picked himself up and walked away. He was arrested, and on being questioned could only say that he was seized with an impulse to jump over, and at once did so. He made no further attempt on his life. This condition is important from a medico-legal point of view in many respects—for instance, in cases in which a person is run over. A man under the influence of alcohol may suddenly conceive the idea of crossing a road, and this idea he will act upon at once without considering the traffic, and regardless of any consequences to himself. His loss of muscular control will also render him liable to accident. A slip on the kerb may cause him to fall under vehicles occupying the roadway, or to injure his head or other part of his body against pavement or adjacent railings.

At length the patient may reach a stage of complete insensibility; he becomes speechless and comatose, a condition commonly spoken of as "dead drunk." It is further interesting to note that the full narcotic effect of alcohol may shield the subject from harm. For example, a drunken man may sustain but small injuries from falls which might be calculated to severely hurt a more sober person. Again, a man who is drunk will sometimes remain longer immersed in water without drowning than a sober man who is able to swim. This result is probably due to the former making less efforts to save himself than the latter; less water is taken into the lungs in the efforts of respiration, and exhaustion does not ensue so rapidly.

Recovery from the full narcotic effect of alcohol may take place after a long sleep, or, more abruptly, if vomiting occurs. On the other hand, death may occur with symptoms of collapse.

2. **Chronic Alcoholism.**—*Symptoms.*—This condition may cause organic and functional affections of all the important organs of the body. At first the symptoms are not such as to induce the patient to seek medical advice, and consist in a general listlessness and lack of energy. The mental powers are enfeebled, and the patient displays indecision in matters of even very slight importance. Tremor soon makes its appearance,

and affects hands, feet, lips, and tongue. The general aspect of the patient is somewhat characteristic; the features are flabby, well-marked small veins may be developed on the face and nose, and the eye may exhibit a slight yellowish tint. The eyelids may be slightly swollen, especially in the morning, and the tongue is usually furred and tremulous. The appetite is poor, amounting often to an actual distaste for food, and there may be nausea and vomiting in the morning. There is sometimes catarrh of the intestinal mucous membrane, producing either looseness of the bowels, or constipation and diarrhoea may alternate. When definite changes are taking place in the liver, that organ may be tender and enlarged in the early stages of cirrhosis; but when the condition becomes more advanced, the liver is small and contracted, and dropsy, jaundice, and possibly vomiting of blood from the stomach, may ensue. The inflammatory processes affecting the nerves give rise to wasting and weakness of muscle, to pain, to impaired sensation, and to muscular tenderness, especially of the legs. Cramps and numbness are also complained of. The chronic alcoholic is also a great sufferer from insomnia, and when sleep at length does come to him, he is disturbed by the nature of his dreams and by the jumping and cramps of his limbs.

Restlessness and nervousness pass into melancholia, leading to suicidal tendencies. The mental and intellectual processes are impaired, and the moral sense is blunted, so that falsehood and deceit become almost habitual. Frequent promises of reform in the lucid intervals are only followed by further relapses, until serious organic disease develops. The progress of the case may be punctuated at intervals by attacks of delirium tremens, or the incidence of the disease may fall so markedly upon one organ or system as to completely overshadow the other symptoms of the primary condition. Thus, the case may then present itself as one of peripheral neuritis, cirrhosis of the liver, heart failure, or dementia.

3. **Delirium Tremens.**—This condition usually comes on in chronic alcoholism, and its onset is frequently determined in the alcoholic by some injury or surgical operation. It is a matter of common knowledge amongst medical men how frequently patients in hospitals who have sustained a fracture or some injury necessitating their admission into the wards develop this condition three or four days subsequently. There is a preliminary stage before the onset of the acute delirium in which the patient shows signs of restlessness and nervousness.

The appetite for food is lost, and even the desire for drink may be completely absent. The restlessness gradually increases, and a marked tremor is manifest in the hands, lips, and tongue, this being a further development in the symptoms of chronic alcoholism mentioned above.

The mind is active, and the delirium which now sets in is of a "busy" character. The patient is ever anxious to "move on," to get out of bed, and has to be restrained to prevent him from doing so. He soon imagines that he sees all manner of horrible things around him, and becomes greatly alarmed because of rats, snakes, beetles, and other objects which he believes to be crawling over him.

He may be suspicious of those around him, and imagines them to be insulting him, or to be offering him poisoned or offensive food. Yet in spite of his delirium he may be able to give rational answers to questions, before he again rambles off in his delirium to fresh conceptions of his distorted imagination.

Patients in this condition are particularly insusceptible to pain, and they will toss about a fractured leg—nay, even walk upon it—without apparent discomfort.

In most cases the symptoms begin to pass off in three or four days; sleep comes to the patient, the tremors cease, and the hallucinations of his disordered brain disappear; very gradually recovery takes place. In other cases the debilitated heart fails, and the patient dies from exhaustion.

### Disease.

1. **Caused by Alcohol.**—Delirium tremens is mentioned above under the heading of the immediate and subsequent effects of alcoholism, as is also chronic alcoholism. This is purely for convenience of classifying a series of events; for delirium tremens and chronic alcoholism may, in fact, be considered as diseases.

Alcoholic drinking affects the following parts:

- |                             |                         |
|-----------------------------|-------------------------|
| (a) The circulatory system. | (e) Alimentary system.  |
| (b) The heart.              | (f) Liver.              |
| (c) The bloodvessels.       | (g) Respiratory system. |
| (d) Nervous system.         | (h) Kidneys.            |

No worse subject for injury or operation exists than the chronic alcoholic, and this term must be taken to include not

only those who are acknowledged drunkards, but also such as are constantly in the habit of taking "occasional glasses." In order to explain this condition, it will be necessary for us to give a brief description of the chief changes which take place in the principal organs and tissues as the result of over-indulgence in alcoholic drinks.

The constant taking of alcohol, even in small quantities at a time, produces definite changes in the

(a) **Circulatory System.**—A single dose will give rise to a temporary dilation of the peripheral vessels, and repeated doses will render this dilation more permanent. It has been demonstrated that the flow of blood through these widened vessels is necessarily retarded, and this effect is still further increased by the impaired action of the heart presently to be considered. Thus a condition of stagnation of the blood-stream ensues, producing congestion of the various organs. But not only does alcohol produce this chronic internal congestion, but it also leads to definite structural changes in the vessel walls, and these alterations interfere with the normal passage of the nutritive blood-plasma from the smaller vessels into the surrounding tissues. The healthy nutrition of the tissues depends upon their constant immersion in a stream of nourishing blood-plasma; and hence, owing to the morbid conditions mentioned above, the circulation fails in the case of the chronic alcoholic to supply that adequate nourishment which is necessary for the integrity of the tissues.

Not only does alcohol act upon the tissues in this indirect way: it also acts as a direct poison to the tissues themselves. Thus the effect of constant dosage with alcohol is to produce a degenerate tissue, little capable of repair after injury. It is generally admitted that injuries in alcoholic subjects undergo repair much less readily than in abstainers. In the latter the living tissue is not degenerate, and possesses a capacity for growth by which repair is more rapidly and thoroughly effected. This impairment of reparative power in the tissues is partly the result of a diminished proliferative capacity on the part of the living elements themselves, partly the result of a diminished power of resistance to the invasion of micro-organisms; thus injuries in alcoholic subjects are more liable to be followed by serious inflammatory processes. The result of bacterial invasion is that the injury is rendered more severe, the general condition of the individual more precarious, and convalescence is retarded.

(b) **The Heart.**—Fatty degeneration of the muscle tissues of the heart is a characteristic feature of chronic alcoholism, and as a result its contractile power becomes enfeebled. Such a condition of the heart muscle naturally acts very prejudicially upon the chances of a patient who has sustained a severe injury, especially if it necessitates the administration of an anæsthetic. It is not the patient with definite valvular disease of the heart who is a dangerous subject for anæsthesia; it is rather the working man who has been constantly in the habit of drinking, perhaps never to the extent of being drunk, but whose tissues are degenerated by alcohol, and the heart muscle in a state of fatty degeneration. Such a man may perchance have sustained a severe fracture of the leg, and an anæsthetic may be necessary for the proper fitting together of the broken fragments. Chloroform is administered with all due precaution, yet the heart suddenly fails, and death may be the result.

(c) **Bloodvessels.**—It has been mentioned above that definite structural changes are produced in the walls of the arteries as the result of alcoholism, changes which interfere with the normal transudation of fluids through the walls into the surrounding tissues. Atheroma of the aorta and changes in the aortic valve are produced, thereby increasing the risk of serious damage to the valve as the result of injury. It is worthy of note that in such subjects severe muscular exertion may produce rupture of one of the curtains of the valve. The changes in the smaller vessels make them brittle, and render them more liable to rupture than healthy vessels, and hence slight injuries may lead to extensive bruising of the tissues, interfering with the normal functional activities of the part. Alcohol may also be indirectly connected with a disease of the arterial walls known as aneurism. This condition is produced when an artery permanently yields under the pressure of the blood within it. Normally, such yielding is prevented by the strength of the vessel wall and by its elasticity. Healthy arteries have such a reserve of resistance over and above all demands that can be made on them, that simple increase of blood-pressure (whether it be due to increased action of the heart or increased resistance in the capillary vessels) cannot by itself produce an aneurism. But when the strength or the elasticity of an artery is lessened, it may yield under even a normal blood-pressure; much more so it may give way when at the same time that blood-pressure is increased. Alcoholism then may produce aneurism in the



following ways: it may by its direct action on the vessel walls produce atheroma, and diminish the resisting power of the vessel wall itself; and by causing frequently repeated overaction of the heart it subjects the weakened vessels to increased blood-pressure. If a person the subject of an aneurism meets with an injury which affects the diseased vessel, the consequences may be of the gravest character.

(d) **Nervous System.**—Degenerative changes are produced in the nervous system, both in the brain (central) and in the nerves (peripheral), as the result of chronic alcoholism. These changes render individuals, especially those engaged in certain trades, peculiarly liable to injury. Many accidents are the results of falls, miscalculations as to distances when moving about amongst machinery, unsteady gait, or tremors or uncertainty of movement of hand or arm, all due to the depressing effect of alcohol upon the nervous system generally and on the brain. This action of alcohol upon the nervous system is also shown by the frequency with which acute delirium follows operations and injuries in alcoholic subjects. A well-known result of the action of alcohol on the nerves is inflammation of the nerves (peripheral neuritis). Individuals in whom the legs are thus affected would be more prone to accident than healthy persons. It must be borne in mind, however, that every change in the nervous system of a person who has been in the habit of taking alcohol must not be put down to that cause. Thus, in the early stages of general paralysis of the insane or in disseminate sclerosis, many of the symptoms are such as are quite compatible with the diagnosis of alcoholism, and yet the diseases in question are only occasionally brought about by alcoholic excess, and even then there are probably other factors also at work.

(e) **Alimentary System.**—In chronic alcoholism the lining (mucous membrane) of the stomach becomes thickened, and its glands undergo degenerative changes. A congestive condition leading to catarrh is also common in the intestines. As a result the digestive and absorptive powers of the alimentary tract are interfered with, and hence indirectly the general reparative properties of the tissues also suffer. Such subjects stand injury and operation badly.

(f) **Liver.**—Cirrhosis of the liver is probably more often due to alcoholism than to any other cause. Individuals so affected are most unfavourable subjects for any severe operations. If dropsy (ascites) also be present, the possibility of operative

procedures after severe accidents is considerably lessened, and consequently satisfactory treatment is often greatly interfered with.

(g) **Respiratory System.**—From the point of view of accident, the effect of alcohol on the respiratory system lies chiefly in the fact already mentioned, that alcohol reduces the body temperature very materially. Consequently if, after receiving an injury, an alcoholic person is unduly exposed to cold, pneumonia is very liable to occur. The prognosis in such cases is generally bad.

(h) **Kidney.**—There are no alterations in the kidney characteristic of the effects of alcohol, although chronic inflammatory changes are common, especially when associated gout is present as a disease. In kidney disease, the retention of the poisons that are normally excreted by the kidneys produces a condition known as uræmia. (See below, Diagnosis—(e) Uræmia.)

### Operation.

No operation can possibly cure acute or chronic alcoholism, and operations upon an alcoholic individual are not to be undertaken lightly.

There are certain operations for the relief of the diseases caused by alcohol, especially for the relief of the dropsy which is caused by alcoholic liver disease, but these hardly find a place here.

### Cure.

The effects of alcohol upon the human body are permanent and transient. The permanent effects are incurable, though the evil consequences may be alleviated. (See above, Operation.)

It is obvious that the repair of a fractured bone, or of a wound of an operation rendered necessary by an injury, may be most prejudicially affected by reason of the violence of the patient's movements during the acute stage of delirium tremens. Thus the bones of the leg may unite in a faulty position, leading to a varying degree of disability which will either remain permanent or require operative measures at a later date for its rectification, thereby delaying the patient's convalescence. But not only may the union be faulty, but it will be most certainly slow. The tissues of the body are exhausted by the acute delirium through which the patient has passed, and they have lost much of their reparative powers. Thus

the normal period for recovery after injury may be doubled, or even trebled.

### Return to Work.

The working capacity of a drinker depends upon the nature of his work, and cannot be reduced to a precise calculation, as there are too many causes to be considered in each individual. (See above, Physiology, etc., of Alcohol.)

### Recurrence.

The only aspect of this question that need be referred to is the well-known tendency of the reformed drunkard to return to his previous condition.

### Occupation Disease.

Certain classes of workmen, owing to the nature of their employment, are particularly liable to fall victims to alcoholism. Such are draymen, brewery hands, potmen. Owing also to the present customs of conducting business, commercial travellers are tempted to partake of excessive quantities of alcohol.

### Diagnosis.

I. **Of Acute Alcoholism.**—The diagnosis is attended with much difficulty, since the coma may be due to other causes as well as to alcohol. The more common causes of coma are—

- |                      |                         |
|----------------------|-------------------------|
| (a) Alcohol.         | (e) Uræmia.             |
| (b) Apoplexy.        | (f) Diabetes.           |
| (c) Epilepsy.        | (g) Injury to the head. |
| (d) Opium-poisoning. | (h) Sunstroke.          |

It is impossible to make a diagnosis of alcoholism without first excluding those other conditions which of themselves may cause coma, or may be brought to bear in conjunction with alcohol.

(a) **Alcoholic Coma.**—In this condition the patient's face may be pale or flushed. The respirations are regular and deep, but not generally noisy (stertorous). The temperature is almost invariably below normal. The condition of the pupils is of importance. Glaister's rule is said to be quite reliable in cases of pure alcoholic coma: "If an alcoholic, completely unconscious, be allowed to lie unmolested for half

an hour, and his pupils be then examined, they will be found contracted. But if any external stimulation be applied to the body, the pupils will be then seen to gradually dilate, while he remains all the time completely comatose. If he then be allowed to remain quiet for ten, fifteen, twenty, or thirty minutes, the pupils will be found to have returned to their original contracted condition." It is this contraction and dilation which is said to be the characteristic pupillary reaction in alcoholic cases, and it differs from other cases of unconsciousness in which the pupils are contracted and fixed, or dilated and fixed, not responding to external stimuli. It sometimes happens in alcoholic coma that the pupils are unequal.

We may here remark that the smell of alcohol in the breath of a patient is not a reliable test as to whether an unconscious patient has been indulging too freely in alcohol. If an individual falls down in the street, obviously very ill, a bystander may give alcohol in some form in the belief that it is the best remedy under the circumstances. The breath may then have the odour of alcohol, although the spirit was not a contributory cause to the accident.

(b) **Apoplexy.**—Its subjects are usually elderly, and information may be obtained from the police, or from bystanders, that the individual fell suddenly. On the other hand, the unconsciousness may not develop for a few minutes after the patient has fallen, or even a longer interval may elapse. The facial aspect varies: it may be pale or flushed; the pupils vary, but are usually dilated, and may be unequal. The breathing is usually noisy (stertorous). Unilateral paralysis of the face and limbs is often present, but in the stage of profound coma the limbs of both sides are so completely flaccid that it is impossible to say whether there is any weakness of one side. As the coma becomes less profound, slight movements may be observed on the unaffected side. In the case of much bleeding (large hæmorrhages), such reflexes as the "knee-jerk," "ankle-clonus," etc., are abolished. Motions (fæces) and urine are generally passed involuntarily, and a specimen of the urine may be found to contain albumin. The pulse is generally slow and of high tension, and the vessels of the body can be felt to be degenerated.

(c) **Epileptic Coma.**—This is more frequent in younger life, and it may be possible to obtain a history of convulsions preceding the coma. The face and lips are congested, and there may be froth, often blood-stained, about the mouth. The face

and tongue may show signs of injury due to previous fits, or the tongue may have been bitten a few minutes before the patient comes under observation. The pupils are usually dilated. Urine and motions (fæces) are often passed involuntarily under the patient. After a fit, such reflexes as the "knee-jerk" may be lost for a short time, but more frequently they are increased.

(d) **Poisoning by Opium.**—A patient poisoned by opium has often taken alcohol or has had it given him, so that the coma may be the result of the two narcotics. The face is usually pale and the lips rather blue; the pupils are minutely contracted. The pulse is slow and feeble, but may be accelerated. The temperature may be subnormal, and the respirations are slow, gasping, and noisy (stertorous).

(e) **Uræmic Coma.**—The state of insensibility may develop after a convulsion, or without any warning. The coma at first is not so deep as in apoplexy, and the patient may be momentarily roused. The pupils are most frequently contracted; the breath has a characteristic uræmic odour, and other signs of kidney disease may be discovered, notably albumin in the urine, also swelling of eyelids and enlargement of the heart.

(f) **Diabetic Coma.**—The urine is found to contain a large quantity of sugar, and it also contains other substances—namely, acetone and diacetic acid—which are not normally present. The breath has a peculiar sweetish odour, and the tongue is red and "beefy-looking." A peculiar type of breathing known as "air-hunger" is characteristic of this condition; the breathing is deeper, but not more frequent than usual. This symptom, however, is not always present. At first the patients are simply drowsy, but the drowsiness gradually passes into profound unconsciousness (coma).

(g) **Injuries to the Head.**—These may produce two conditions—concussion or compression of the brain.

*Concussion of the Brain.*—The symptoms vary in intensity from a temporary giddiness or confusion of thought to the most profound insensibility. The symptoms of concussion are usually most marked directly after the injury, and if they are found to increase in severity, it is always due to some condition additional to mere concussion—for example, bleeding inside the skull (intracranial hæmorrhage). Except in the gravest cases of concussion, the patient makes some response to external stimulation. The respirations are slow, shallow, and sighing; the pulse is small, soft, and usually slow. The pupils are equal,

and generally react to light. The muscles are relaxed, but there is no actual paralysis. There may be unconscious evacuations of rectum and bladder.

*Compression of the Brain.*—The patient is absolutely unconscious, and cannot be roused by external stimulation. The pulse at first is full and slow, but later it becomes rapid and irregular. The breathing is slow, deep, and stertorous. The pupils are dilated, and do not react to light, and they may be unequal. In the later stages there is often paralysis of the limbs. In cases of cerebral compression, an examination should be made for a fracture of the skull. The escape of blood or cerebro-spinal fluid from the ear, or bleeding from the nose, would confirm the diagnosis of a fractured base of the skull.

(h) **Sunstroke or Heatstroke.**—This condition is met with frequently in soldiers on the march, engineers, and stokers in the engine-rooms of steamers and such-like. (See Heat and Tropical Accidents.)

2. **Diagnosis of Chronic Alcoholism.**—This must be diagnosed from the following conditions :

- (a) General paralysis.
- (b) Functional nervous condition.
- (c) Dyspepsia.
- (d) Locomotor ataxy.

(a) **General Paralysis of the Insane.**—General paralysis of the insane in its early stages may closely resemble chronic alcoholism. If definite exaltations of ideas be present, the diagnosis is easy, but in certain cases of general paralysis of the insane the early symptoms may not be mental, but bodily, and in these the differential diagnosis is by no means readily made. Signs of disturbance of digestion, such as morning sickness or vomiting, evidence of cirrhosis of the liver, and so on, would point to chronic alcoholism. It should be remembered, however, that alcoholism may play some part in the production of general paralysis.

(b) **Functional Nervous Disease.**—The tremor of chronic alcoholism may resemble certain functional conditions, notably hysteria and neurasthenia. Also the tremors noticed in old age (senility) may resemble those produced by alcohol.

(c) **Dyspepsia.**—The vomiting of ordinary gastric catarrh may give rise to a suspicion of alcoholism, as may also the vomiting of pregnancy; but careful questioning and physical examination will disclose the real state of affairs. The state of

the tongue should be specially noticed, a very fine tremor gives rise to suspicions of alcohol.

(d) **Locomotor Ataxy.**—Certain symptoms in locomotor ataxy may resemble those of chronic alcoholism; but here again an examination of the eyes, together with the characteristic symptoms of the former disease and the state of the reflexes, will give valuable information.

### The Malingerer.

There are contingencies under which a man might try to simulate the symptoms of drunkenness in order to avoid the responsibility of acts (generally criminal) which he is accused of having committed. The imitation of drunkenness has been a favourite subject with dramatists, notably in the well-known play of "David Garrick," which is represented to have a foundation in fact.

### Death in Alcoholism.

Sudden death may occur in alcoholic subjects owing to heart failure, and, as already mentioned, this result may be brought about as a result of injuries or during the course of a surgical operation, in spite of every precaution. Death may also occur as the result of delirium tremens evoked by injury of a predisposed subject.

An important factor in death from alcoholism, especially in the acute form, is cold. Alcohol lowers the body temperature considerably. As already pointed out, one of the earliest effects of the drug is to cause dilation of the vessels of the skin, and thus a considerable amount of heat is lost. If, therefore, a person in a drunken condition meets with an accident, and is subsequently exposed to a cold atmosphere, he is more likely to suffer serious effects therefrom than a sober individual.

Another point which may be mentioned is that alcoholics exhibit a poor resistance against erysipelas, and this disease is liable to produce dangerous and fatal complications. A case is quoted by Brouardel (*loc. cit.*, p. 318) which well illustrates this point: In the kitchen of a restaurant in one of the boulevards of Paris, the plate-washer and a scullion were quarrelling. They became more angry, and the scullion threw a dish at the plate-washer's head; the dish did not break, but the plate-washer received a small superficial wound on his forehead. He was taken to a druggist, who gave him a "vulnerary" draught, and he then took several nips of spirits to steady his nerves. Two

days after erysipelas set in, and he died. An autopsy on the plate-washer's body was made: the kidneys were found contracted, and the liver showed a typical condition of cirrhosis.

### **Criminal and Self-inflicted Wounds.**

We have shown elsewhere how action follows idea in the alcoholic, and this feature leads to fatal results either from accident or suicide. The question of suicide in alcoholics is, however, a large one, and scarcely finds a place in this article.

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*For legal cases concerning Alcohol see CASE GUIDE : Alcohol.*

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## **AMIDO BENZENE.**

*See* POISONS.

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## **AMPUTATIONS.**

*See* THE PARTICULAR PARTS AFFECTED—BONES, NERVES,  
MUSCLES, TENDONS, AND LAW CASES.

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## **ANEURISM.**

*See* HEART, VESSELS.

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## **ANILINE.**

*See* POISONS.



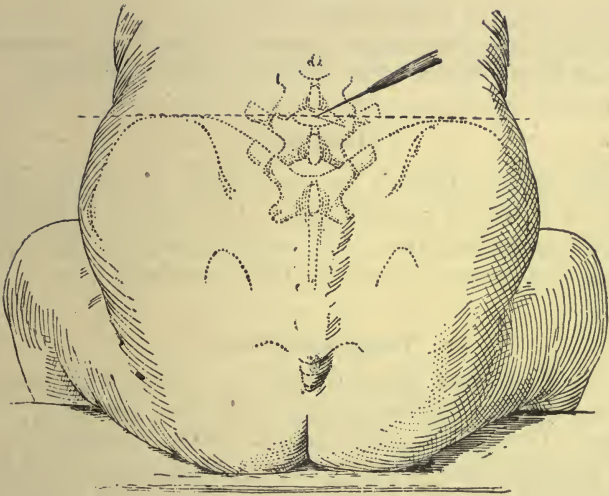


FIG. 5.—SCHEME OF PATIENT'S BACK IN THE SITTING POSTURE, WITH HYPODERMIC NEEDLE INTRODUCED BETWEEN TWO VERTEBRÆ FOR THE PRODUCTION OF SPINAL ANÆSTHESIA.

(From Rose and Carless's "Surgery.")

# ANÆSTHETICS.

By J. BLUMFELD,

M.D. CANTAB., B.A., B.C.,

Senior Anæsthetist to St. George's Hospital, London; Hon. Anæsthetist to St. Mary's Hospital and to Hospital St. John and Elizabeth.

## Head-note.

THE one serious risk to be considered in connection with anæsthesia is that of a fatal result. This may be brought about during the administration of an anæsthetic, or may ensue as a later result of damage caused by the anæsthetic drug.

## Technical Terms.

*A.C.E.*.—A mixture, for inhalation, of alcohol, chloroform, and ether, in the proportions by volume of one, two, and three.

*Alÿpin.*.—This is a recently introduced local anæsthetic, and it is largely employed by operators on the nose and throat in conjunction with the use of a general anæsthetic. It is painted on the parts to be operated upon.

*Ätröpine.*.—This is very rarely used for the production of anæsthesia by hypodermic injection, but is often used before the administration of ether and chloroform, for its power to diminish glandular secretions—*i.e.*, the mouth is kept dry, and there is less expectoration. By this use of atropine vomiting after anæsthetics is held to be diminished, and also the liability to heart failure during their action.

*C.E.*.—A mixture, for inhalation, of chloroform and ether, in the proportions by volume of two-fifths of chloroform and three-fifths of ether.

*Chloride of Äthÿl.*.—See Ethyl Chloride.

*Chloroform.*.—Chloride of methyl— $\text{CHCl}_3$ —a colourless, transparent liquid, volatile, but less so than ether. When chloroform is exposed to sunlight or to a naked flame, decomposition is liable to occur, with the formation in each case of poisonous carbonyl chloride. The vapour of chloroform is inhaled with large quantities of air, generally speaking the proportions used being about 2 per cent.

chloroform vapour to 98 per cent. air. This is merely approximate. The liquid chloroform has a slight blistering action if applied to the skin.

Besides its action as a general anæsthetic, chloroform is sometimes employed locally for its sedative effect—viz., on an exposed nerve of a decayed tooth.

*Cocaine.*—A chemical substance (an alkaloid) made from a South American plant called *Erythroxylon coca*. When dissolved in water, it is used in a weak solution to produce local anæsthesia. For this purpose the solution is either injected under the skin by a hypodermic syringe, or painted upon the soft lining skin of the body (the mucous membrane) wherever needed.

The strength of the solution is usually  $\frac{1}{2}$  to 1 per cent. when injected, but when applied externally it is used considerably stronger. The use of cocaine is not without danger, the risk depending on idiosyncrasy. The undesirable symptoms are widely dilated pupils, convulsions, or fainting (syncope).

Cocaine is often administered in conjunction with general anæsthetics because it diminishes liability to reflex failure of the heart by reason of its deadening action upon the nerves.

*Ether.*—Ethylic ether— $(C_2H_5)_2O$ —a transparent, colourless, volatile liquid which, when mixed with air, explodes in the presence of a flame or dull red heat. It is made from spirits of wine or ethyl alcohol. There is another kind in common use, the methylic ether which is prepared from methylated spirit, known as “rectified methylated ether.” There is very little difference, if any, between the two forms for anæsthetic purposes. The vapour of ether is inhaled from various forms of apparatus which serve to control the mixture of air and the evaporation of the very volatile liquid. It is about one-seventh as potent in its effect as the same volume of chloroform vapour, and consequently is often safely employed without the admixture of air.

Ether was at one time used for local anæsthesia by freezing the skin with a spray causing rapid evaporation; this method is now employed with the aid of ethyl chloride, and ether is not so used.

*Éthyl Chloride.*—A colourless, extremely volatile liquid, generally supplied in glass tubes under pressure, from which it is liberated in a spray by opening a small tap. The tubes should be labelled, stating the fitness of the contents for the production of general anæsthesia, as impure varieties of ethyl chloride are in common use for producing local anæsthesia.

For the latter purpose it is sprayed on the skin, where it produces its effects by a freezing process, caused by its extremely rapid evaporation. As a general anæsthetic, it is used either for very short operations or as preliminary to the administration of ether and chloroform. It is not nearly so free from danger as laughing gas

(nitrous oxide). It produces unconsciousness with greater rapidity than any other anæsthetic drug. It is commonly used nearly pure, being administered by methods which involve the exclusion of air to a greater or less extent. When air is excluded, unconsciousness is produced, even in adult subjects, in the space of less than a minute. In the case of children we have known absolute unconsciousness produced in two breaths. It frequently produces nausea, differing in this from "laughing gas."

*Eucaine.*—A white crystalline body, whose properties are allied to those of cocaine, than which, however, it is considerably less poisonous. It is used in solutions in strength of  $\frac{1}{2}$  to 2 per cent., a maximum quantity of 2 grains being employed. As a local anæsthetic applied to surfaces and not injected, it is not nearly so efficacious as cocaine; for this reason it is rarely used by ophthalmic surgeons.

*Morphia.*—The active principle of opium. It is often given by hypodermic injection before administering ether or chloroform. It lessens the amount of anæsthetic required, and makes the relaxation of the muscles easier of attainment.

*Nitrous Oxide.*—"Laughing gas," or protoxide of nitrogen. Chemical formula,  $N_2O$ . Kept in a gaseous form this suffers rapidly from mixture with air, and is consequently supplied by the manufacturers as a liquid, which is kept under high pressure in an iron cylinder. Nitrous oxide is the safest anæsthetic known, but it is not applicable to long operations except as a preliminary to other drugs. The reason why it cannot be used continuously for long periods of time is, first, the inconvenience of a number of heavy iron cylinders; and, secondly, the fact that it does not always properly relax the muscular system.

*Novocaine.*—This is another local anæsthetic which has recently come into vogue. It appears to have no special use except for the production of spinal anæsthesia. (See below, Spinal Anæsthesia.)

### The Kinds and Methods of Anæsthesia.

Anæsthesia is the condition in which there is insensibility to pain. It is produced artificially in three ways :

I. **General Anæsthesia.**—By inhalation into the lungs, and secondarily into the blood-system, of gases which produce a quieting effect upon the activity of the nervous system. The highest activities of the nervous system, which are responsible for the presence of consciousness as well as for the perception of pain, are those most readily affected, and so unconsciousness is produced and pain abolished before the vital centres which control the heart and breathing are gravely affected. This is what is known as "general anæsthesia," and is commonly

produced by the use of either chloroform, ether, nitrous oxide, or ethyl chloride, either singly or in combination.

2. **Spinal Anæsthesia.**—A recent method of producing anæsthesia in the case of operations below the level of the navel. This consists in the injection of certain drugs into the spinal canal, by means of a hypodermic syringe with a long needle. [Fig. 5.] These drugs are stovaine, novocaine, tropa-cocaine, and eucaine, all of which have entirely replaced in this connection the use of cocaine, which was first used, but which was found to be highly dangerous. This method has also been employed for abolishing pain during labour. The contractions of the uterus and delivery of the child are said to be not interfered with. This form of anæsthesia has been followed by paralysis of various forms, and in some cases by inflammation of the spinal cord, resulting in death. Sudden death has also attended the injection into the spinal canal. Generally speaking, the greatest advantage of this form of anæsthesia is its power to prevent shock. It is used in cases requiring immediate and extensive operation after a severe accident, such, for instance, as the amputation of both lower limbs. It is also of use in cases where the inhalation of a general anæsthetic has some special and serious danger, as, for instance, in cases of advanced diabetes or of failing heart.

3. **Local Anæsthesia.**—This is produced by (a) injection; (b) painting; (c) freezing.

(a) *Injection under the Skin.*—Injection is performed by means of a small syringe attached to a hollow needle, the whole being called “hypodermic syringe.” The drug is dissolved in perfectly clean water, and then injected into the body, usually under the skin.

Injection into the nerve trunk is occasionally employed.

Injection is also made into the successive layers of tissue, as they are exposed in the course of an operation (regional anæsthesia).

(b) *Painting.*—Painting the anæsthetic upon the moist, internal skin (mucous membrane) of the body.

(c) *Freezing.*—Freezing of the skin. (See Technical Terms, Ethyl Chloride.)

### Danger of Anæsthetics.

Since many accidents entail the taking of anæsthetics, either for immediate aid or for the subsequent rectifying of some bodily defect, it is necessary briefly to consider the risks run in this connection.

The risks arising from anæsthetics will differ markedly as they are incurred by an individual who is—

1. In normal health, except for the accident.
2. In an abnormal state of health, or disabled in some manner which interferes with the taking of anæsthetics. (See below, Disease.)

**In Normal Health.**—We must first consider, then, the risks of anæsthetics in the case of an average healthy adult. In doing so we shall, as far as possible, estimate the risk from the anæsthetic as entirely separate from the other risks of the operation. We shall, in fact, consider the matter as though the operation being undergone was a minor one, and the risk to life from shock, hæmorrhage, etc., were negligible; although in actual practice it is sometimes impossible to separate the two risks or to determine accurately, in a fatal case, to what extent the result was due to operation, and to what extent to the inhalation of an anæsthetic. This is one reason for which statistics regarding anæsthetic fatalities are misleading. Cases are included in which the causation of death was practically not influenced by the anæsthetic, and others are omitted in which the anæsthetic probably played an important part in leading to a fatal result. It may, however, be useful to mention some figures that have been gathered under trustworthy conditions, and that may well be regarded as providing a good rough estimate of the risk of anæsthetics. These figures have been collected in connection with operations upon all kinds of individuals, including those who were already very ill; and therefore the risk to the healthy adult, which we are considering, may be regarded as being represented by an even lower figure than those hereafter mentioned. It might be supposed that valuable and authoritative statistics could be got at once from the Registrar-General's tables. Unfortunately, however, the fallacy above alluded to comes largely into play in connection with the material supplied to the Registrar-General, and also there is no doubt that many cases in which a fatality occurs, not in a hospital or other institution, do not get reported as cases of anæsthetic fatality. Numbers large enough to give a valuable general idea of the risk have been collected in connection with chloroform and ether. I quote the following from Dr. F. W. Hewitt's book on anæsthetics: "The late Sir B. W. Richardson obtained records of 35,162 chloroform administrations with 11 deaths, giving a death-rate of 1 in 3,196, and of 8,431 ether administrations with but 1 death." Dr. Julliert, of

Geneva, has collected from various reliable sources records of no less than 839,285 ether and chloroform administrations.

The following table shows the relative frequency with which chloroform and ether were used, with the relative death-rates:

	Anæsthetic	Number of Administrations.	Total Deaths.
Dr. Julliert	Chloroform	524,507	161 (1 in 3,258)
	Ether	314,738	21 (1 in 14,987)
Dr. Bromley, of Dublin	Chloroform	152,260	53 (1 in 2,873)
	Ether	82,815	4 (1 in 23,204)
	Chloroform mixed with ether	11,176	2 (1 in 5,558)
	Bichloride of methylene	10,000	2 (1 in 5,000)
St. Bartholomew's Hospital, 1875 to 1900	Chloroform	42,978	33 (1 in 1,300)
	Ether	37,277	4 (1 in 9,319)

Broadly speaking, the death-rate with chloroform may be regarded as about 1 in 3,000, and with ether 1 in 10,000. It is obvious, however, that any such reckonings must be largely of a speculative nature. One factor alone which is of enormous importance in actual practice is not considered in the accumulation of statistics—viz., the personal experience and skill of the administrators concerned. The mortality from deaths under anæsthetics, as indicated by the annual reports of the Registrar-General for England and Wales, was on an average, in the years 1902 to 1906, 157·1 a year.

In these 786 deaths, the anæsthetic used and the number of deaths resulting were :

Chloroform	...	...	...	478
Ether	...	...	...	41
Nitrous oxide	...	...	...	11
Nitrous oxide and ether	...	...	...	3
A.C.E. mixture	...	...	...	16
Chloroform and ether	...	...	...	17
Ethyl chloride	...	...	...	15
Atropine	...	...	...	1
Drugs not stated	...	...	...	204

These figures clearly show that a considerable number of deaths during anæsthesia occur yearly. No attempt at an

accurate computation of the number of administrations yearly has been made, but Dr. Silk has given reason to show that it is unlikely that these amount to less than one million in England and Wales. It is obvious then that, in spite of the considerable number of yearly fatalities, the risks of anæsthesia may be regarded, broadly speaking, as slight. In fact, when it is a question of an operation which is not in itself dangerous from extent, severity, or loss of blood, when the anæsthetic is in skilled hands, and when the subject is in average health, it may fairly be said that the risk is negligible. This holds true whatever anæsthetic may be chosen. Given, however, chloroform as the selected anæsthetic, and an inexperienced administrator to give it, the risk is so greatly increased that no comparison can be made between the two sets of circumstances.

**Delayed Chloroform-Poisoning.**—There is one more anæsthetic risk that must be mentioned, which may supervene in any case, but the true explanation of which is at present not forthcoming. We refer to the condition known as delayed chloroform-poisoning. This is a state usually fatal, the occurrence of which is rare, and not limited entirely to cases in which chloroform alone has been used, although this anæsthetic has provided the majority of instances. It is most common in the case of children.

A further risk to be mentioned is that of serious lung trouble in the shape of bronchitis or pneumonia, supervening upon the inhalation of an anæsthetic. Such a consequence is extremely rare in the case of healthy individuals.

### **Disease and Other Conditions influencing the Effects of Anæsthetics.**

We have now to consider the risk of anæsthetics when they are applied to persons who are not in average health, or who are suffering from injury immediate or remote. It is clear that statements made above will no longer apply, and that in various ways the impaired condition of the subject will enhance the danger of anæsthesia. Exactly what are those ways we must consider in some detail, and perhaps the simplest way of doing so will be to approach the subject from the point of view of the various regions of the body. First, however, we may clear the ground by some general observations that will enable us to dispose of the cases of recent injury, and leave us free to deal seriatim with the remote effects of injury and with diseases.



The following conditions, on account of their effect upon the successful administration of anæsthetics, have to be seriously considered :

1. Recent injury.

- (a) Shock.
- (b) Collapse.

2. Parts of the body operated upon in persons in weak health or diseased state :

- (a) Limbs.
- (b) Head (brain).
- (c) Face.
- (d) Nose.
- (e) Neck.
- (f) Chest.
- (g) Ribs.
- (h) Lungs and pleural cavity.
- (i) Heart.
- (j) Abdomen.
- (k) Genitals.

3. Sex and age.

1. **Recent Injury.**—(a) *Shock*.—In all cases of severe injury where immediate operation is demanded, there is one factor present which greatly concerns the question of administration of an anæsthetic. This is the condition known as shock. Shock is a state in which the vital powers of the organism are greatly lowered, and in which the force of the circulation of the blood, particularly, is at a dangerously low ebb. Now, the inhalation of anæsthetics is associated, at one period or other during the inhalation, with some lowering of the normal blood-pressure. It can easily be seen, therefore, how much an inhalation may endanger the life of a person who is already in the lowered state of shock.

It is true that we have methods—as, for instance, the employment of spinal anæsthesia, or the combined use of morphia and ether by the open method—which enable anæsthetics to be used with advantage even in cases of profound shock. Such methods are, however, not always available, and we have to consider the question as it may affect those subjected to severe injury who are so situated that the latest devices are not ready for their aid. Moreover, in such cases as we are now considering there is another danger, supposing the operation to have been safely endured. This is the risk of reactionary

shock. The action of the anæsthetic, although it may, as has been stated, at first accentuate the shock, will subsequently correct it, and will, so to speak, veil the shock during the performance of the operation. Later, when the operation is over and the effects of the anæsthetic may have passed off, it is not uncommon for the state of shock to reappear, and in so marked and aggravated a form as to tell most gravely upon the vital powers of the patient.

(b) *Collapse*.—Closely allied to shock is the state of collapse. This is the term applied to that condition in which the lowered powers of the body are due to loss of body fluids—that is to say, in case of injury, to the loss of blood. The extra risks incidental to anæsthesia in case of shock from recent injury apply also to cases where collapse is present from a similar cause. Statistical evidence on this point is not available, but it may be stated with certainty that, although anæsthetics are able to counteract shock, and to render operations possible during this condition which would be otherwise impossible, yet the risk of anæsthesia during a state of shock or collapse is much greater than in the absence of these conditions.

2. **Parts of the Body to be operated upon in Persons in Weak Health or Diseased State**.—Coming now to consider the risk of anæsthesia in the case of persons who, although not the subjects of very recent damage, are yet in defective bodily health or condition by reason of previous accident or illness, we may view the matter systematically, according to the part of the body affected.

(a) *Limbs*.—We may first put out of court all cases in which the damage is confined to one or more limbs, for from the point of view of anæsthetics such damages will in no way jeopardize the patient's chances. An exception to this will be when the local damage has resulted, by reason of blood-poisoning, in a defective general state of health. In such cases of general blood-poisoning there is additional risk in anæsthesia. The risk, however, is not great, for by proper minimizing of the anæsthetic employed competent anæsthetists can bring such cases to a satisfactory conclusion.

(b) *Head (Brain)*.—In cases where the interior of the skull is to be operated on for tumour, abscess, etc., the result of former injury, the risk of anæsthesia *per se* is slight. Such cases, however, when the operation is a prolonged one, provide some of the most pronounced examples of shock to be met with, and since chloroform is, from the operator's point of view, the only

admissible anæsthetic, the risk to life becomes great. The risk is reduced as far as possible by the use of a very low percentage vapour of chloroform employed with continuous inhalation of oxygen.

(c) *Face*.—Operations upon the face are unassociated with any special anæsthetic risk, except that chloroform has to be employed. If the operation is a long one, the position of the head required by the operator is often one that increases the danger arising from the use of the anæsthetic.

(d) *Nose*.—The same remark applies to operations upon the interior or back of the nose, such as are sometimes rendered necessary by damage done to the bones or cartilages of this organ. In these cases there is also the additional element of risk arising from the difficulty of preventing blood from entering the air-passages. The risks are met by details in the management of the patient's position, and of the exact degree of anæsthesia employed. But these cases must be regarded as holding more than the ordinary risk of anæsthesia.

(e) *Neck*.—Operations upon the neck are associated with risks similar to those just mentioned. There is also in some of these cases the additional factor provided by pulling or pressure upon the important nerves that lie deep in the neck. When these nerves are interfered with in the course of operation, the action of the heart and the proper performance of respiration are liable to be affected in a way which seriously aggravates the action of the anæsthetic.

(f) *Chest*.—Coming to operations upon the chest, we may dismiss in a few words those which are limited to the outside of this part of the body, and do not, therefore, involve the opening of the coverings of the lungs or heart.

(g) *Ribs*.—In simple cases, as, for instance, in operation for a diseased rib, there is no extra anæsthetic risk unless the site of operation is such that the patient must be turned completely on to one side. In such a case, if the patient be very fat, and particularly if he be obliged to lie upon the left side, there is some interference with the freedom of breathing, and also with the action of the heart, that does prejudice anæsthesia. In the position indicated, and in such a portly subject as is here supposed, the position of the face, lower jaw, and tongue, is unfavourable for the free performance of unobstructed breathing, and extra care is required to remove all risk during the taking of anæsthetics under these conditions.

(h) *Lungs and Pleural Cavity*.—When we consider the question

as it affects operations within the chest—*e.g.*, for removal of fluid pressing upon a lung or for opening an abscess in the lung itself—the undesirable consequences of position which we have just described come into play as before, but they are here aggravated by effects more serious still. We have now to do with subjects in whom even in the most favourable position of the body there is one lung either useless for breathing purposes or only partially effective in its work. It can easily be understood how grave is the danger when the position for operation demands that the patient should lie upon the side which contains the sound lung, for in such a posture the sound lung itself is not free to expand in the ordinary way. For the surgeon to get at the diseased lung or its covering, it may be necessary for him to place the patient in a position which hampers the movements of the sound lung. The risks of anæsthesia are hereby much increased. Nor does the latter risk depend solely on the fact that the position of the patient hampers his breathing or the action of his heart, or both. It depends also on this fact, in the case of operation for collection of fluid within the chest, that the fluid may find its way into the bronchi, the large divisions of the windpipe. Now, such an event might not be very serious if the patient were lying upon the bad side, the use of which for breathing purposes is already very deficient. When, however, this side is uppermost, and fluid enters the bronchi of that side, the fluid may gravitate into the bronchi of the side on which the patient is lying, and if the fluid is considerable in quantity the sound lung is overwhelmed and the patient is drowned.

(i) *Heart*.—Operation within the chest for relief of fluid surrounding the heart is associated with risk on account of the extremely serious general condition of the patient when such operation is required, and because of the difficulty such a patient has in breathing when he lies upon his back. To sit up and lean forward is usually the manner in which a patient thus afflicted seeks the minimum of discomfort in breathing, and yet such a position cannot be maintained during operation without insuperable inconvenience.

(j) *Abdomen*.—Operations within the abdomen are liable to be associated with extra anæsthetic risk by reason of the extremely deep degree of anæsthesia which at times must be of necessity maintained. This very deep degree of anæsthesia entails an added risk from shock when this phenomenon is produced by the operation, and when chloroform is, as it

sometimes must be, the anæsthetic employed. This danger is enhanced by the restrictions put upon the patient's breathing powers by the presence of the wound in the abdomen. The anæsthetic risk in long abdominal cases is not at an end when the patient has safely left the operating-table. There is later a chance of dangerous lung affections from the long inhalations of anæsthetics, and the long exposure of considerable surfaces of the body or some of its contents, applies also to long operations on or within the chest.

(k) *Genitals*.—Operations upon the genital organs are unassociated with any extra risk, except that, inasmuch as the part operated on is of a highly sensitive nature, a particularly deep anæsthesia is required.

The statement often made, that a special danger from shock is incurred when the spermatic cord is divided, is not borne out by the facts, if the anæsthetic is properly regulated.

3. **Sex and Age: Women and Children.**—Generally speaking, all that has been hitherto said applies equally to women and children. There are, however, a few points peculiar to them. In the first place, by reason of their feebler muscular development, women and children are easy subjects in whom to produce anæsthesia, and are free from those complications which arise in connection with muscular spasm. Moreover, in the case of children, the elasticity of the chest allows of recovery after the cessation of breathing from conditions which would be highly dangerous in the case of adults. It is this fact which has given rise to the fallacious impression that chloroform is not so dangerous to children. As regards women, there is in connection with childbirth a frequent necessity for the use of chloroform. It is not, however, generally necessary to use chloroform to an extreme degree, and this fact renders the employment of chloroform during childbirth less serious than it is under other circumstances. Moreover, the presence of pain and the eagerness of the patient herself for an anæsthetic remove all risk on the side of the patient's mental attitude, a risk that is present to some degree when a nervous woman has a fear of taking an anæsthetic. Also, the increased strength of the heart during pregnancy helps to lower the risk.

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*For legal cases connected with Anæsthesia see Medico-Legal Aspect of Accidents—Operation and CASE GUIDE: Anæsthesia.*

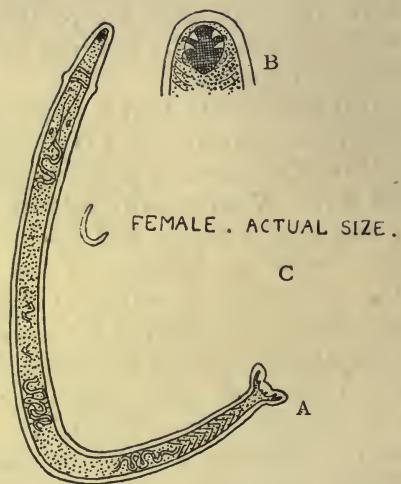


FIG. 6.—ANKYLOSTOMA, UNCINARIA.

A, Magnified male ; B, mouth, showing four hooklets ; C, female, actual size.

# ANKYLOSTOMIASIS.\*

SYN.: UNCINARIASIS, HOOKWORM DISEASE,  
MINER'S ANÆMIA.

By A. E. BOYCOTT,

M.A., M.D.,

Lecturer on Pathology, Guy's Hospital.

## Head-note.

THE chief danger from this disease is that of bloodlessness, or anæmia. In addition, the risk of spreading the disease to others must also be considered.

## Technical Terms.

*Larva*.—The stage in the growth of worms, insects, etc., which occupies a middle position between the egg and the perfect animal. (The caterpillar is the larva of the butterfly.)

## Nature of the Infection.

Ankylostomiasis is caused by a small parasitic worm (*Ankylostoma*, *Uncinaria*), the length of which when fully developed is about  $\frac{1}{2}$  inch, and which lives in the small bowel of man. [Fig. 6.]

The female here lays an enormous number of eggs, which are passed out of the body in the stools. If the eggs now find themselves in a place where there is a free supply of air, sufficient moisture and warmth (about 70° F.), they hatch and give rise to a young worm (larva). This larva grows quickly, till in a few days it reaches a stage (full-grown larva) beyond which it does not grow so long as it remains outside the human body.

If it now gains entrance to the human body, either by being

\* A disease which is included in the third schedule of the Workmen's Compensation Act, 1906.

swallowed or by boring its way through any part of the skin, it reaches the intestine, where it undergoes further development into a worm, and in about six weeks it becomes an adult worm, which lives fastened on the wall of the small bowel. It is now capable of laying eggs. If the larva does not get into the human body, it can live in water or wet mud for many months.

The eggs or young larvæ die if they are swallowed, and cannot pass through the skin; only the full-grown larvæ can convey the disease to man. Hence the stools of a person harbouring the worms cannot convey the disease to a second person, or to himself, for several days after leaving the body. The worm is peculiar to man, who cannot, therefore, contract the disease from lower animals, such as horses.

The conditions of warmth and moisture necessary for the proper development of the full-grown larvæ are such that the disease is, in temperate climates, practically confined to mines and similar warm wet places which are liable to be soiled with human excrement.

In the tropics the disease occurs everywhere. The disease cannot be contracted by simple contact with a person harbouring the worm. If the stools are passed into any ordinary form of sanitary receptacle, the propagation of the disease is prevented.

### Consequences of Ankylostomiasis.

(a) **Time required to produce Symptoms after Infection.**—Only the full-grown worm produces definite illness. It may therefore be reckoned that at least two months must elapse after the worm has entered the body before the person can be definitely ill. This is of importance in determining the place where the person became infected.

(b) **The Effects of the Parasite on the Human Body (Symptoms).**—Many people who harbour the worm suffer no ill-effects at all. Such individuals are known as “worm-carriers”; they cannot be said to be suffering from “ankylostomiasis.” In others various ill-effects are produced, for there is no doubt that there is individual variation in the resistance of different people to the poisonous substances produced by the worms. The number of times the individual becomes infected, and the number of worms which gain entrance, are very important factors in determining whether he becomes actually ill or not.



*Boils.*—The skin where the full-grown larvæ enter is irritated, and eruptions are produced varying from trivial pimples to severe boils, which may incapacitate from work.

*Pains in the Stomach.*—The presence of worms in the upper part of the small bowel may give rise to a certain amount of pain in the upper part of the abdomen. This pain is generally attributed to indigestion, but is usually trivial in degree.

*Shortness of Breath (Anæmia).*—The chief effect of the worm on the body is to produce a deterioration (anæmia) of the blood, which becomes paler and more watery than usual, as is seen in the appearance of the patient's lips. This anæmia causes shortness of breath, which is more marked on exertion. It varies in degree in different persons, from those who only feel unduly breathless on making considerable muscular efforts to those who are so short of breath that they are confined to bed. The breathlessness is often associated with feelings of giddiness and faintness, which may lead to accidents by falling, etc. Besides disturbing the breathing, the poorness of the blood is liable to derange any of the functions of the body; thus, digestion is usually impaired, lassitude is common, the eyesight may be dim, etc.

#### Disease.

##### Existing before the Accident, and aggravating its Effects.

—Other diseases do not predispose to ankylostomiasis, though persons sick from some other cause doubtless feel the effects more severely.

#### Operation.

None required.

#### Cure.

In the great majority of cases, appropriate treatment by drugs very rapidly results in complete restoration of health. Even if only the majority of the worms are got rid of, the impoverishment of the blood and the symptoms usually improve very quickly.

In moderately severe uncomplicated cases, a cure should result within two months. The time, however, varies very widely in different persons. Long-standing cases in middle-aged people may take many months; young well-fed subjects who have only been ill for a short time recover very quickly. A person in whose stools the eggs of the worm can no longer be found is not necessarily cured, unless his blood is restored to a normal condition.

### Return to Work.

Many of the slight and moderate cases are capable of doing light work which does not involve much muscular effort—*e.g.*, working on the surface instead of underground at a mine. They can well be kept under medical treatment while so engaged. It is not necessary that work should be stopped altogether except for the twenty-four hours while the medicine is actually working. In the same way, very severe cases may return to light work when their blood is somewhat improved, and before they would be able to undertake heavy work without undue breathlessness. The capacity for work cannot be judged by the presence or absence of the eggs in the stools. A person may be restored to health and a few worms still be present in his bowel, and, on the other hand, all the worms may be killed, but the restoration of the blood may take several weeks, or in rare cases many months.

Apart from the sensations of the patient, the test of complete cure is the state of the blood. If the patient be still anæmic, he is uncured and incapable of full work.

### Recurrence.

After cure there is no risk of recurrence unless a fresh lot of worms is taken into the body. This usually occurs if the person returns to his former occupation, since he probably goes to work in a place where full-grown larvæ still occur.

### Occupation Diseases.

This is so essentially a disease of miners that it is included in the third schedule of the Workmen's Compensation Act, 1906, as occurring "in the process of mining."

The epidemic of anæmia which occurred among the borers of the St. Gothard Tunnel is the classic instance of a widespread attack of this disease among persons engaged in work analogous to mining.

### Worm-carriers.

Persons who harbour the worm, but suffer no illness in consequence, cannot be said to suffer from ankylostomiasis. They may, however, require notice, as they are capable of spreading the eggs, and so conveying the disease to other people.

### Diagnosis.

The fact that a person harbours *Ankylostoma* can be established by finding the eggs of the worm by microscopic examination of his stools. To establish that the illness—shortness of breath, etc.—of which the person complains is due to the parasite, it is necessary to exclude other possible conditions (diseases of the heart and lungs, and other kinds of anæmia) which might give rise to the same symptoms. The most satisfactory proof is probably obtained by observing the result of treatment.

### The Malingerer.

It is important to be certain that the stools which are examined were actually passed by the person in question; fraud in this matter is not unknown.

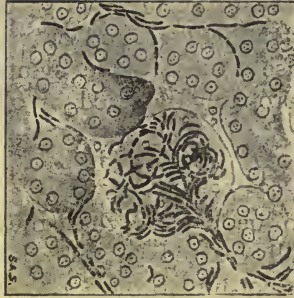


FIG. 7.—ANTHRAX BACILLUS IN THE KIDNEY.  $\times 600$ .  
(After Crookshank.)



FIG. 8.—ANTHRAX BACILLUS.  $\times 1,200$ .  
(After Crookshank.)

# ANTHRAX.\*

By F. W. EURICH,

M.D.,

Honorary Physician, Royal Infirmary, Bradford; Bacteriologist to the City of Bradford and to the Anthrax Investigation Board for Bradford and District; Professor of Forensic Medicine at the University of Leeds.

## Head-note.

ANTHRAX in man is at first a local disease, but with a tendency in many cases to become generalized, in which event death supervenes in twenty-four to forty-eight hours.

## Technical Terms.

*Alpaca*.—Hair obtained from the paca or paco, an animal allied to the llama; a native of South America.

*Antiseptic*.—Preventing fermentation—*i.e.*, the growth and activity of germs, without necessarily killing them.

*Asthënic*.—Without strength; applied to disease or to cases in which prostration is a marked symptom.

*Bacillus, Bacterium*.—Rod-shaped organisms belonging to the class of fungi which propagate by simple division (fission-fungi).

*Cūtānēous*.—Appertaining to the skin.

*Ĕrysipēlatoid*.—Like erysipelas.

*Hæmorrhage*.—Bleeding.

*Infection*.—The entry of germs into the body.

*Lēucocytōsis*.—An increase of certain of the white cells of the blood.

*Mohair*.—Hair obtained from the mohair (Angora) goat, a native of the plateaux of Central Asia.

*Nēcrosīs*.—Death of parts of the body (*e.g.*, bone or skin) as opposed to death of the body as a whole.

*Opsonic Index*.—One of the defensive forces of the body against the invasion of microbes is phagocytosis (see below). The entry of germs may stimulate or may depress it. The amount of phagocytosis of which a patient's blood is capable can be estimated, and the com-

\* A disease which is included in the third schedule of the Workmen's Compensation Act, 1906.

parison of this with the degree of phagocytosis shown by the blood of a healthy individual is termed the "opsonic index," normal phagocytosis being taken as unity.

*Phagocytōsis*.—The faculty which certain of the white cells of the blood possess of swallowing (ingesting), and so destroying, bacteria and other germs. [Fig. 109.]

*Pleura*.—A delicate, smooth membrane investing the lungs and lining the interior of the chest where this comes in contact with the lungs. [Fig. 137.]

*Pneumonia*.—Inflammation of the lungs.

*Pulmonary*.—Appertaining to the lungs.

*Sepsis*.—A term applied principally to the action of various harmful germs upon the blood.

*Serum*.—The portion of the blood that remains fluid after clotting has taken place.

*Spores*.—Some bacteria have the faculty of each forming a spore or seed under certain conditions. These spores, being highly resistant to heat and antiseptics, act as a means of preserving the unit.

*Syncope*.—Sudden failure of the heart's action.

*Virus*.—Poison. A term generally applied to the living bacteria and other micro-organisms.

### Nature of Anthrax.

Anthrax is an infective disease of animals, especially of the Herbivora, the virus being a bacillus which is capable of producing spores. Anthrax in man is directly due, in the vast majority of cases, to contact with an infected animal or its products. As the distribution of anthrax is world-wide, it follows that not only are the butchers and fellmongers endangered when they chance to come in contact with indigenous cases of anthrax in the course of their employment, but also those numerous work-people who are called upon to handle the produce of foreign herds—*e.g.*, the sorters and combers of Persian wool, of mohair, and of alpaca; the workers in Russian and Chinese horsehair, and the tanners of foreign hides. It is therefore, in the main, an industrial disease.

The bacillus of anthrax is not a hardy organism; its vitality is readily affected by heat, by drying, and by direct sunlight. [Figs. 7, 8.]

The bacillus has, however, the power of forming spores outside the animal body under certain conditions. These conditions are generally fulfilled when the germ-laden blood of an infected beast is shed, and allowed to dry on hair or skin.

As the anthrax spore is extremely resistive to physical and chemical influences, the raw materials which are contaminated by it may prove a source of danger even after the lapse of years. Infection may thus be conveyed to man either by the fluid or by the dried blood, the brittle, germ-laden particles of the dried blood being diffused with the dust rising from the wool or hair. In each case, the bacilli or their spores may effect an entry into the body, and may, after an incubation period of twenty-four to forty-eight hours, give rise to symptoms which will vary according to the mode of infection. The bacilli may enter by:

- (a) The skin.
- (b) The lungs.
- (c) The alimentary canal.

From which the disease may spread to produce—

- (d) Generalized anthrax.

### Consequences of Infection by Anthrax.

(a) **By the Skin: "Cutaneous Anthrax."**—Infection of the skin is facilitated by open sores, scratches, cuts, etc., but it is conceivable that with vigorous friction the germs may be rubbed into the unbroken skin to a depth sufficient to enable them to develop. The immediate effect of such development and multiplication of the virus is a local inflammation, with a tendency to mortification of the centre of such inflamed area. This area is the so-called "anthrax pustule" (malignant pustule). It is characterized when fully developed by a black mortified centre surrounded by a ring of small blisters, and these in turn are surrounded by a dusky red halo upon the swollen, brawny skin. The pustule begins to form twenty-four to forty-eight hours after the infection has taken place, and another three or four days see it fully developed. In rare cases, instead of the pustule being formed, there is produced a diffuse redness and swelling of the skin closely resembling erysipelas (erysipelatoid anthrax; syn., malignant anthrax œdema).

As long as the virus is confined to the pustule alone, so long is the patient not in immediate danger of his life. But the bacillus may pass by way of bloodvessels and lymph-channels into the general circulation, and so give rise to a generalized infection. The ultimate result of generalized anthrax is, with scarce an exception, death.

(b) **By the Lungs: "Pulmonary Anthrax."**—This affection partakes of the character of bronchitis, pneumonia, or influenza. It produces intense prostration from the start, and frequently ends in a rapid and fatal collapse on the third to the fifth day, or even earlier.

(c) **By the Alimentary Canal.**—This is rare in man. The bowel, however, may become affected secondarily in generalized anthrax. There is vomiting or retching, and diarrhœa. The stools are tarry in appearance from the presence in them of decomposed blood, and the patient is feverish, restless, and rapidly collapses.

(d) **Generalized Anthrax.**—As in malignant pustule, so in the case of pulmonary and intestinal anthrax, the bacilli may pass into the general circulation, and thereby infect the rest of the body. This is termed generalized anthrax, and is the terminal stage of almost all fatal cases of anthrax whatever be the mode or site of infection. As the lungs and bowels are more freely supplied with blood and lymph than is the skin, it will be readily understood that pulmonary and intestinal anthrax tend specially to a dissemination of the virus and the production of generalized anthrax.

### Disease.

1. **Caused by Infection with Anthrax Germs.**—The varieties of anthrax mentioned above.

2. **Existing before the Infection and aggravating its Effects.**—Excepting the conditions mentioned above, which facilitate the entry of the germs of the disease, cutaneous anthrax appears singularly independent of predisposing causes, or of conditions likely to accentuate the local effects. But other organisms are often grafted upon the anthrax sore, and it is conceivable that they may produce their own special effects, and thus retard recovery or add to the danger. It is possible, too, for a severe attack of cutaneous anthrax to weaken the resisting power of the patient towards some other infective disease, such as pneumonia. The degree to which this is possible cannot be formulated.

Recovery from pulmonary anthrax being so rare, nothing is definitely known as to immunity conferred by one attack, or as to the effect, if any, that the disease may have upon disease of the lungs, such as phthisis. Little is known as to predisposing conditions. Argument from analogy makes it highly probable that subjects congenitally weak, or enfeebled by



malnutrition, by disease, or by alcohol and other poisons, would be especially liable to take the infection.

### Operation (Treatment).

The treatment for anthrax is of four kinds :

- (a) The injection of antitoxin.
- (b) The injection of carbolic acid round the malignant pustule.
- (c) Excision of the malignant pustule.
- (d) Operations for complications.

(a) **The Injection of Antitoxin.**—The earlier the patient presents himself for treatment, the greater will be the likelihood of cure. The treatment that is adopted in all cases when opportunity offers is the injection of Sclavo's anti-anthrax serum. This injection is made either under the skin or into a vein; it is generally followed by a period of reaction (especially when the serum is introduced into the vein), during which the patient is more or less feverish, and may possibly develop a rash or joint-pains. This reaction is only of a few days' duration, and involves no risk to the patient.

(b) **Injection of Carbolic Acid round the Malignant Pustule.**—When anthrax is limited to the skin alone, the surgeon may treat the disease locally by the injection of some powerful antiseptic (*e.g.*, pure carbolic acid) into the skin around the pustule. The injection of carbolic acid is painful, but introduces no risks.

(c) **Excision of the Malignant Pustule.**—As long as the disease has not spread beyond the skin, excision of the diseased area is commonly performed. Excision being, as a rule, performed under general anæsthesia, it introduces such risk as attends the administration of the anæsthetic employed [see Anæsthetics]; the risk is a remote one, as the operation is a short and trifling one. The tissues through which the operator's knife passes must be free from bacilli, as otherwise fresh facilities for spreading may be given by the operation itself. As it is impossible in any given case to state with accuracy the depth to which the bacilli may have advanced, some surgeons deem it safest not to excise the pustule. On some parts of the body, also, excision is impracticable—*e.g.*, on the eyelids.

(d) **Operations for Complications.**—Fluid often collects in the pleural cavities, but is rarely so abundant as seriously to

impede respiration, and so to call for tapping. Though, in a patient suffering from anthrax, the tendency to collapse would render this little operation not free from risk, yet it would be a rational undertaking if in the opinion of the doctor the patient's condition might thereby be relieved. In some cases in which there has been extensive destruction of tissue, and especially where there is danger of serious deformity (as on eyelids or nose), skin-grafting may be necessary, but this will be performed after the immediate effects of the infection have been recovered from.

### Cure.

In malignant pustule, if the organisms remain localized, early cure may be expected.

As a general rule, eight or nine days decide the patient's fate, and as the constitutional disturbances subside the patient's strength rapidly returns. He often feels himself again within a fortnight of the onset (see below, Return to Work).

### Return to Work.

**Cutaneous Anthrax.**—The patient would be able to return to work forthwith were it not for the fact that the wound formed by the malignant pustule, or left by the operation, has yet to heal. This, depending as it does largely upon the size of the wound, may be a matter of some weeks.

On no account may a workman return to work involving a risk of re-infection ere the wound is completely healed.

**Pulmonary and Intestinal Anthrax.**—Where recovery takes place after these serious conditions, the man will require time to regain his strength. This would probably take a month or six weeks.

### Recurrence.

Recurrence of the disease is not possible; but, of course, re-infection may take place. If one attack confer immunity, such immunity is probably of short duration. A case is on record in which a man had practically recovered from an anthrax pustule on the back of the neck, but, contaminating his fingers, re-infected himself—this time fatally—through his gastro-intestinal tract.

On the other hand, it does not appear that one attack predisposes to a second.

### Occupation Disease.

As has been mentioned above under the heading of Nature of Anthrax, to which reference should be made, anthrax is essentially a disease of contact with either the living Herbivora when infected with anthrax or their products, more especially their skins and hair. Anthrax has, however, been contracted in the bacteriological laboratory.

### Diagnosis.

(1) The diagnosis of malignant pustule is easy when the pustule is well developed. The possibility of a pustule being anthrax must be kept in mind, for it is at first often overlooked, even when occurring in subjects whose work may expose them to infection. A bacteriological examination—viz., an attempt to cultivate the bacillus from the contents of the vesicles or from the discharge—should never be omitted. A positive result proves the correctness of what is, after all, only an opinion, and it has the further advantage of enabling others to support the diagnosis at a time when all clinical symptoms may have disappeared. The result of a bacteriological examination will also be material to the medical evidence should a claim be made and contested. The attempt to grow the bacilli may fail, even if anthrax bacilli were present at the time, because the blood possesses germicidal properties which may have been in operation successfully before the examination was made. It is useful, therefore, to possess a second test; but it is one requiring considerable experience of its technique. This is the estimation of the opsonic index. An index more than a decimal fraction above or below the normal indicates an infection with anthrax bacilli, but a normal index does not necessarily negative such infection. The index generally returns to normal in the third week after infection has occurred. A third test is that of the inoculation of mice or other lower animals which are susceptible to anthrax with material from the suspected individual.

(2) The diagnosis of anthrax of the lungs (pulmonary anthrax), and of (3) anthrax in the alimentary canal (gastro-intestinal anthrax), is very difficult. The disease can generally be only suspected—at least, in its earlier stages.

The opsonic index may be of use, and it may be possible to cultivate anthrax bacilli from blood or fluid drawn from the chest in the case of pulmonary anthrax, or the bacilli may be recovered from the fæces in intestinal cases.

In generalized anthrax the bacilli may be obtained from the blood, especially from regions in which the blood-stream is confined to the narrowest channels (the capillaries)—*e.g.*, from the tip of the finger or from the lobe of the ear. The finding of bacilli in the general circulation generally implies the death of the patient within the next twenty-four hours.

After death the appearance of the internal organs, though suggestive, are not absolutely characteristic; they are those of some general septic process—*viz.*, congestion (especially of the lungs), a pulpy consistence of the spleen, fluid in the chest (pleural cavities), hæmorrhage (especially into the glands at the roots of the lungs, into the walls of the intestine, and into the membranes covering the brain). A microscopic examination of the blood is not sufficient, as bacilli of putrefaction may closely resemble those of anthrax. Certainty can only be obtained by cultivation and inoculation experiments. But as the bacillus of anthrax readily succumbs to the effects of putrefaction, all traces of its presence in the body may be lost thirty-six to forty-eight hours after the death of the patient, unless some of the infected blood be shed, and in consequence of the *presence of the air* the bacilli have formed spores, which will retain their vitality for a long period, as mentioned above under Nature of Anthrax. To avoid the formation of spores especial care is taken, after death from anthrax of animals, that no incision is made.

### Malingering.

Simulation of anthrax in any form is, I believe, unknown. No artificial means could produce a similar pustule, and the constitutional symptoms are beyond all power of imitation. The failure to find the specific bacillus is naturally of importance.

Should a patient claim to have passed through an attack of anthrax unattended by a doctor (and spontaneous cure of malignant pustule is known to occur), or perhaps in spite of his doctor's opinion to the contrary, he could prove his case only by means of an estimation of his opsonic index.

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*For legal cases on Anthrax see CASE GUIDE: Anthrax.*

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## AORTA.

*See* HEART, VESSELS.

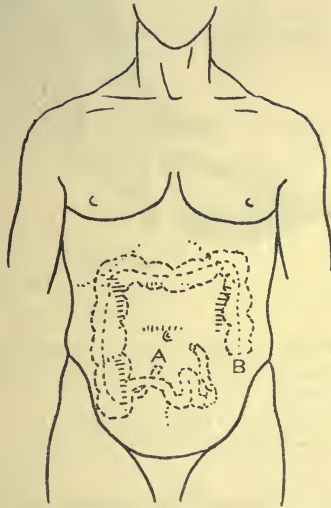


FIG. 9.—THE APPENDIX, A, TURNED UPWARDS BEHIND THE SMALL INTESTINE. The small intestine cut above enters the large intestine (colon), which is cut on the left side at B, where it approaches the commencement of the back-passage (rectum).

Band of muscle fibres in the wall of the large intestine  
(ascending colon), which is here cut across.

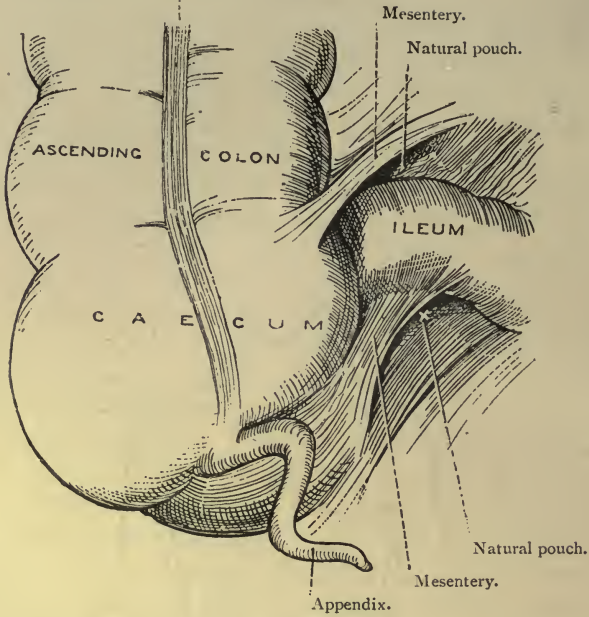


FIG. 10.—APPENDIX, SHOWING ITS ATTACHMENT TO THE BLIND COMMENCEMENT (CÆCUM) OF THE LARGE INTESTINE (COLON), JUST BEYOND THE END OF THE SMALL INTESTINE (ILEUM).

(Buchanan's "Manual of Anatomy.")



FIG. 11.—APPENDIX CONTAINING A CONCRETION, WHICH HAS CAUSED IT TO BECOME INFLAMED AND FATALLY PERFORATED.

Small intestine not shown.

(Rose and Carless's "Manual of Surgery.")

# THE APPENDIX.

BY JAMES SHERREN,

F. R. C. S.,

Surgeon to the London Hospital; Surgeon to the Poplar Hospital  
for Accidents; late Erasmus Wilson Lecturer,  
Royal College of Surgeons.

THE danger from an injury to the appendix is that it may set up appendicitis, of which the most serious consequence is peritonitis.

## Technical Terms.

*Adhesions (Bands), Inflammatory.*—Strings or bands of fibrous tissue, the product of inflammation in the abdomen, chest, sheath of the heart, or a joint. During formation they contract and bind organs together, producing constrictions, displacements, and fixity of parts that were formerly movable. By their binding together contiguous intestines, they are apt to make pockets or artificial sacs into which portions of the intestine may pass and produce an internal rupture. [Fig. 113.]

*Appendicitis.*—The name given to inflammation starting in the neighbourhood of the appendix, due to its disease.

*Appendix.*—A blind tube attached to the junction of the large and small intestine, measuring  $3\frac{1}{2}$  inches long and  $\frac{1}{4}$  inch in diameter. (See below, Vessels.) [Figs. 2, 9, 10, 11.]

*Bands.*—See Adhesions.

*Cæcum.*—The cæcum (*cæcum intestinum* — blind bowel) is that portion of the commencement of the large bowel situated below the point at which the small bowel joins it. It is about 2 inches in length, and of the same diameter as the rest of the large bowel. In herbivorous animals it is large, and serves a digestive function. [Figs. 10, 11.]

*Diaphragm.*—The muscular partition between the chest and the abdomen. [Figs. 2, 3, 4.]

*Fæcal Fistula.*—An abnormal channel communicating between the outside skin and the bowel, through which the contents of the bowels are discharged upon the surface.

*Fistula.*—An abnormal channel between a hollow organ and the skin, through which it opens, or between two hollow organs.

*Pěvřtõnĕum*.—The lining of the abdominal cavity. (For full description, see Peritoneum, Anatomy.) [Figs. 150, 151, 152.]

*Pěvřtõnĕitis*.—Inflammation of the peritoneum.

*Portal Vein*.—The large vein which carries the products of digestion from the stomach and intestines to the liver, entering the liver on its under surface. [Fig. 133.]

*Pleurisŷ*.—Inflammation of the membrane that lines the cavity of the chest and covers the lung.

### Anatomy.

The appendix vermiformis is a slender tube of an average length of  $3\frac{1}{2}$  inches, and of an average diameter of  $\frac{1}{4}$  inch. It is situated low down on the right side of the abdomen, near the junction of the large and small intestine. It opens into the blunt end or beginning (cæcum) of the large intestine; its other end terminates blindly. Its direction varies; usually it points upwards, and to the left, behind the termination of the small intestine. [Fig. 9.] Occasionally it lies on the outer side of the large bowel, or it may hang into the cavity of the pelvis. [Fig. 10.] The direction taken by the appendix has an important bearing upon the course of the disease. The appendix is completely enveloped in the lining membrane (peritoneum) of the abdomen.

The interior of the appendix is lined by a membrane continuous with that lining the large bowel. The appendix not infrequently contains a hard, round, or oval concretion, formed from the excreta (fæces) in the bowel and the secretion of the membrane lining it. Such concretions often resemble fruit-stones and grape-pips, and have given rise to the erroneous impression that these frequently find their way into the appendix and cause its inflammation. In rare cases foreign bodies, such as small shot, or occasionally a pin, are found in the appendix, but seldom give rise to trouble. On the other hand, the presence of a concretion formed as above within the cavity of the appendix is a frequent predisposing cause of its disease. [Fig. 11.]

### Consequences of Accident.

An attack of appendicitis may be caused by—

1. Abdominal contusions.
2. Sprains.

It has been estimated that injury of a diseased appendix is the exciting factor in an attack of appendicitis in about 7 per



cent. of the cases of the disease. Hence, not more than one case in fifteen is caused by accident. In an absolutely healthy appendix injury never causes an attack of appendicitis. In these cases, however, the patient may not be aware of any pre-existing disease.

### Disease.

1. **Caused by the Accident.**—As has been stated already, injury never causes an attack of appendicitis in an absolutely healthy appendix, although in many cases the individual may not be aware of any previous disease. The symptoms always come on immediately after the accident, or within a few hours. If forty-eight hours have elapsed, the responsibility of the accident may be rejected.

An attack may originate from a blow over the region of the right lower abdomen, forcing fluid from the bowel into the unhealthy appendix, whence it may not be able to gain exit owing to a contained concretion playing the part of a ball-valve; this may originate the attack. Or the appendix may be kinked as the result of past inflammation, and a strain may further kink it, interfering with its blood-supply and originating the attack. If the patient has suffered from a previous attack of the disease, there is always a great liability to further attacks. These may result either from a narrowing of the tube due to the contraction of the scar of an old ulcer inside the appendix, with the formation of an abscess, or it may result from the presence of adhesions formed outside the appendix by an old peritonitis. A blow or strain may rupture the diseased appendix, and set free its irritating contents, or, bruising its bloodvessels, may cut off its blood-supply, setting up mortification.

Appendicitis may lead to—

- (a) Peritonitis: localized, diffuse.
- (b) Intraperitoneal abscess (abscess of the abdomen), close to the appendix or under the diaphragm.
- (c) Fæcal fistula.
- (d) Pleurisy.
- (e) Abscess of the liver.
- (f) Intestinal obstruction.
- (g) Abdominal pain due to adhesions.

(a) **Peritonitis.**—Appendicitis always produces peritonitis, which may remain localized round the appendix, or be diffused all over the belly. It is impossible to foretell at its onset what the result of any attack will be. An appendix abscess may

form and burst anywhere near the appendix into the large or small intestine, peritoneum, the bladder, vagina, or through the skin of the abdomen.

(b) **Intraperitoneal Abscess (Abscess of the Abdomen).**—The infection of the peritoneum may lead to the formation of a local abscess, or may spread upwards and cause the formation of an abscess under the diaphragm.

(c) **Fæcal Fistula.**—The wall of the bowel (cæcum) may be affected by the inflammation of the appendix, and the matter (pus) may perforate through the skin of the abdomen. This is most likely to occur when a local abscess has developed.

The contents of the bowel (fæces) then discharge on to the surface through the perforation, which is then called a “fæcal fistula.”

(d) **Pleurisy.**—If an abscess forms under the diaphragm, the inflammation may spread throughout this muscle to the cavity of the chest, and cause inflammation of its lining membrane.

(e) **Abscess of Liver.**—Multiple abscess of the liver may result from the inflammation spreading to the veins of the appendix, and reaching the liver by the great vein (the portal) into which the veins of the appendix open.

(f) **Intestinal Obstruction.**—This may result from gluing together of the coils of intestine as the result of peritonitis, and may supervene early in the attack, or may result months or years after from adhesions which had been formed at the time of the disease of the appendix.

(g) **Peritoneal Adhesions.**—The presence of peritoneal adhesions, the result of the disease, may cause ill-defined abdominal pain.

2. **Existing before the Accident and aggravating its Effects.**—As has been already said, injury to a healthy appendix does not cause appendicitis.

### Operation.

This must be discussed under two headings :

1. During an attack.
2. After the attack has subsided.

1. **During the Attack.**—The risk in operations for appendicitis is in delay, as it is in all other acute diseases of the abdomen. The risk of the operation itself is negligible. It is impossible to foretell at its onset whether an attack will result in diffuse peritonitis or will subside. The death-rate

from acute appendicitis, if the operation for removal of the appendix be undertaken within the first twenty-four hours, is not more than 3 per cent. The risk of the operation is increased after the first twenty-four hours of the disease. When the operation is much delayed, and has to be undertaken because serious complications, such as abscess or diffuse peritonitis, have arisen, the death-rate at the London Hospital for the past ten years has been from 17 to 20 per cent.

(a) **Abscess.**—If the disease has resulted in a local abscess, an operation must be undertaken, the chance being slight of spontaneous relief by the abscess bursting into the bowel. The abscess may burst into the bladder or peritoneal cavity, greatly increasing the danger.

(b) **Diffuse Peritonitis.**—Operation is imperative. The death-rate varies with the extent of the spread of the inflammation over the abdomen (peritoneal cavity), but has diminished during the last two years.

(c) **Subdiaphragmatic Abscess.**—Operation is here again imperative. The condition is difficult of diagnosis.

(d) **Fæcal Fistula.**—When due to appendicitis it usually closes spontaneously. Operation in the rare cases in which it remains open\* is not attended with any special risk.

(e) **Pleurisy.**—See Lungs.

(f) **Abscess of Liver.**—Life is rarely saved even by an extensive operation.

(g) **Intestinal Obstruction.**—Operation must be undertaken at once, and may save life if done within the first few hours of onset.

2. **Operation after an Attack has subsided.**—When a patient has once had appendicitis, there is a great likelihood of recurrence. Operation should be performed, and the appendix removed. This is an operation practically devoid of risk in the hands of an experienced surgeon. The death-rate over a large number of cases is under  $\frac{1}{2}$  per cent.

### Cure.

Cure results after operation in uncomplicated cases. The time necessary for cure will vary enormously.

Under the most favourable circumstances (which are either the removal of the appendix within the first twenty-four or after an attack has subsided), two months from the date of the operation will suffice for cure. But if the necessity for draining the abdominal cavity has arisen, as in appendix abscess or diffuse

peritonitis, the time will be much prolonged, and no period for cure can be fixed, except that a month must elapse from the time when all wounds have healed.

**Pain from Adhesions.**—It is impossible to foretell if a cure will take place; the adhesions often form again. If an operation for dividing the adhesions be performed, four to six weeks will be necessary for recovery.

### Return to Work.

The time for return to work, and the capacity for work, will chiefly depend upon the condition of the abdominal wall, but also upon the presence and the position of adhesions. After removal of the appendix, if the opening into the abdomen was carefully planned so as to avoid cutting the muscles across the direction of their fibres, and if the wound has healed without the formation of matter (pus), return to work may be expected within two months of the operation.

If the formation of matter (pus) has delayed the union of the wound, or if drainage has had to be carried out, a much longer time is necessary. The abdominal wall may remain permanently weak, and a rupture (post-operative ventral hernia) may occur, and the patient be unable to perform laborious work unless the rupture in the abdominal wall is cured by a further operation. After the operation for the cure of a post-operative hernia, six weeks to two months must elapse before the patient is fit for work.

### Recurrence.

After an attack of appendicitis, further attacks are likely to occur even though a local abscess formed and was opened, unless the appendix has been removed.

This recurrence may be expected in at least 30 per cent. of cases.

If the attack has been severe and the appendix was not removed within the first twenty-four hours, the bowel and appendix may adhere from inflammation. Adhesions may cause pain even after the appendix has been removed and the attack has subsided, but this is not common.

### Occupation.

No occupation can be said to entail any special liability to appendicitis. Appendicitis is more common in men than in women, and may occur at any age.

**Diagnosis.**

The presence of pre-existing disease cannot be diagnosed apart from the patient's statement, or that of a medical man who attended him in a previous attack.

The condition of the appendix, as seen on removal, may point to its having been the seat of previous disease. But, as has been said, if an attack of appendicitis does not come on within forty-eight hours after an accident, the accident has not caused the attack of appendicitis.

**Malingering.**

Patients complaining of pain in the appendix region after removal of the appendix require careful examination. Apart from operation it may be impossible to come to a definite conclusion. This difficulty of proving the non-existence of pain is frequently taken advantage of by a malingerer. (See also Abdomen, p. 47.)

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**ARSENIC.**

*See* POISONS.

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**ARTERIES.**

*See* VESSELS.

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**BACTERIA.**

*See* INFECTIONS, PTOMAIN-POISONING.

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**BEAT ELBOW.**

*See* BEAT HAND, BURSAE.

# BEAT HAND, BEAT ELBOW, AND BEAT KNEE.\*

By A. H. TUBBY,

M.S. LOND., F.R.C.S. ENG.,

Surgeon to Westminster Hospital and to the Royal National Orthopædic  
Hospital for the Deformed; Consulting Surgeon to the Evelina  
Hospital for Children;

AND

E. ROCK CARLING,

B.S. LOND., F.R.C.S. ENG.,

Assistant-Surgeon to Westminster Hospital; Senior Assistant-  
Surgeon to the Seamen's Hospital, Greenwich.

## Head-note.

“BEAT HAND” is a term given by miners to a condition not peculiar to them, but occurring in any workmen who habitually use such a tool as the pickaxe.

## Technical Terms.

(See Bones, Bursæ, Joints, Tendons, etc.)

*Cellulitis*.—Inflammation of the soft tissues which lie under the skin (subcutaneous tissue) and between muscles, etc.

## Consequences of Accident.

In consequence of repeated concussions and constant friction, the skin over the palmar aspect of the bases of the fingers, the ball of the thumb, and the outside of the hand, becomes greatly thickened and very hard. Through some slight abrasion micro-organisms become accidentally inoculated, and an acute inflammation results in the deeper layer of the skin or subcutaneous tissues. This condition often goes on to the formation of matter, which burrows and spreads underneath the hardened mass of skin, and occasionally, though very rarely, spreads to the tendon-sheaths. The areas in which matter has formed are known to miners as “keens.” The commonest direction of further spread of matter is to the back of the

\* Diseases mentioned in Schedule III. of Workmen's Compensation Act, 1906.

hand. Beat elbow and beat knee occur in another form than that which is here described. (See Bursæ, p. 198.) For miner's wrist, see Joints, p. 500, and Tendons.

#### Disease.

**Caused by the Accident.**—See above, Consequences of Accident. Complete recovery is almost invariable; occasionally slight deformities of the hand or fingers are left, but they are not such as to interfere with a miner's or labourer's work. In the exceptional cases where the tendon-sheaths become affected, all the consequences detailed under the head of Tendons may ensue.

#### Operation.

Operation is always necessary; the procedure is nothing more than a simple incision, or incisions, to let out the matter. Only in the rarest cases will deformity consequent upon this condition be of such a nature as to justify operation for its cure.

#### Cure and Return to Work.

Of fifty cases occurring among 36,657 miners, the average duration of incapacity was a little under twenty-two days. Three weeks may be taken as the usual period.

#### Recurrence.

There is no special tendency for the diseased condition to recur when once cured, though, of course, a second attack unconnected with the first may be induced by the same causes occurring again.

#### Occupation Disease.

See Head-note.

#### Diagnosis.

The condition is unmistakable, and could not be confounded with any other disease.

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*For legal cases of Beat Hand and Beat Knee, see Medico-Legal Aspect of Accident—Occupation Diseases and CASE GUIDE: Beat Hand, Beat Knee.*

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## BENZENE, NITRO AND AMIDO.

*See* POISONS.

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## BILE AND BLADDER (GALL).

*See* LIVER.

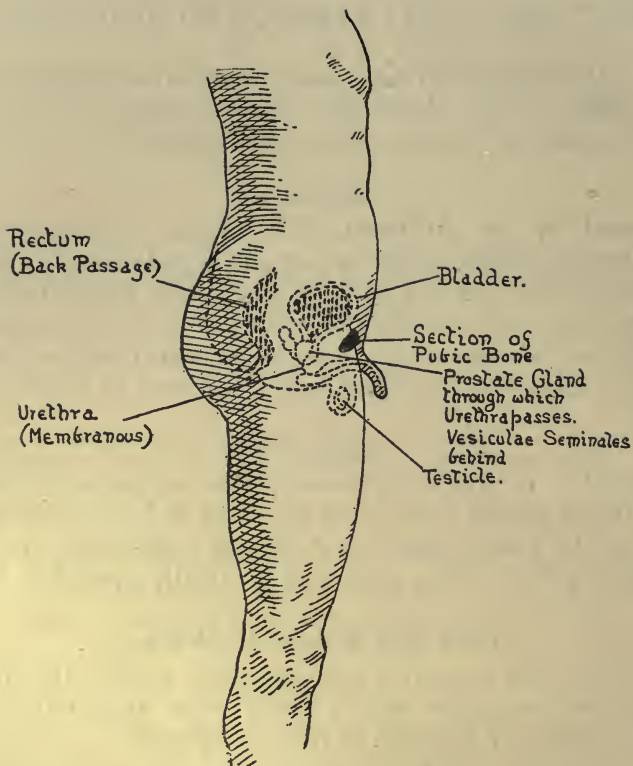


FIG. 12.—PROJECTION OF THE PELVIC ORGANS OF THE MALE.  
The cord from the testicle is not shown, as it lies to the side.

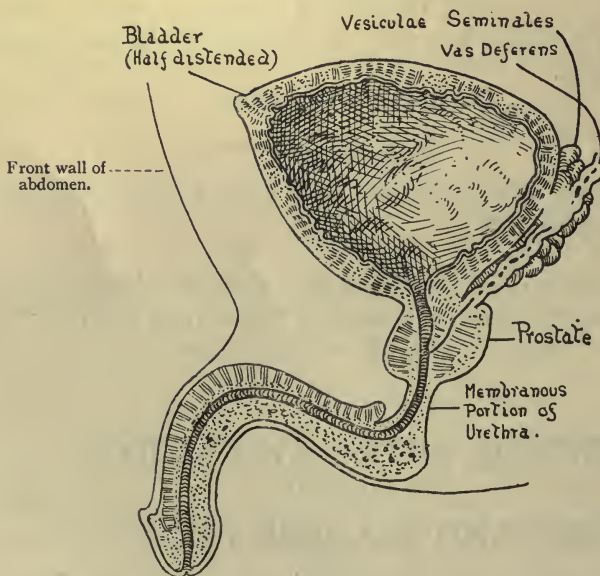


FIG. 13.—REDUCED SECTION OF THE MALE BLADDER AND PARTS NEAR.



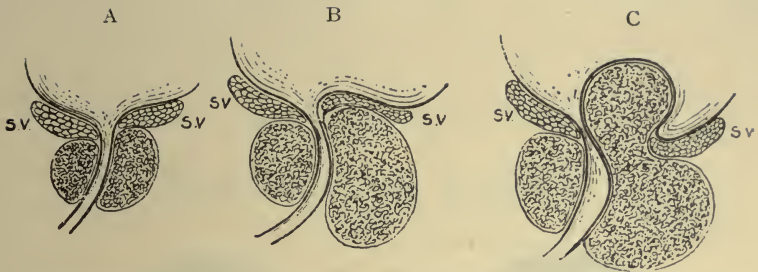


FIG. 14.—SECTIONS THROUGH THE LOWER PART OF THE BLADDER, ITS CLOSING MUSCLE, AND THE PROSTATE GLAND, TO SHOW THE VARIOUS CHANGES PRODUCED BY ENLARGEMENT OF THE PROSTATE GLAND.

A, Normal state ; *sv*, sphincter vesicæ, closing muscle of the bladder, which is partially seen above it. The prostate gland is seen below, surrounding the urethra, or water-pipe, from the bladder. B, The prostate enlarged, chiefly backwards, where it would have projected into the back-passage (rectum), and does not distort the urethra. C, Prostate enlarged, projecting through the closing muscle, *sv*, into the bladder (see Fig. 15), where it distorts the urethra.

(From Rose and Carless's "Manual of Surgery.")



FIG. 15.—BLADDER OPENED FROM THE FRONT, SHOWING PROSTATE ENLARGED TOWARDS THE BLADDER (SEE FIG. 14, C).

(From Rose and Carless's "Manual of Surgery.")

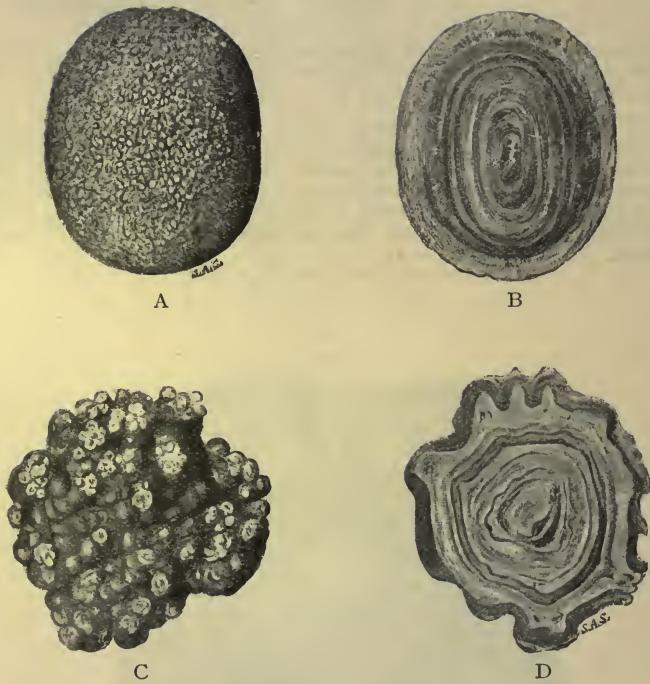


FIG. 16.—STONES, OR CALCULI, REMOVED FROM THE BLADDER OF MEN.

A, Uric acid calculus ; B, the same cut in section ; C, oxalate of lime calculus ; D, the same in section.

(From Rose and Carless's "Surgery.")

# THE BLADDER (URINARY).

By JOHN PARDOE,

M.B., F.R.C.S.,

Assistant-Surgeon to St. Peter's Hospital for Stone and Genito-urinary Diseases, and Assistant-Surgeon to the West London Hospital.

## Head-note.

THE important consequences of injury to the bladder are—

1. Escape of urine into the abdomen.
2. Inflammation of the lining of the bladder.

## Technical Terms.

*Bladder*.—The reservoir for the urine situated in the lower part of the abdomen. [Figs. 12, 13, 15.]

*Calculus*.—A stone formed in the human body in one of the normal canals or reservoirs for fluid—*e.g.*, kidney, urine bladder, gall bladder, etc. [Fig. 16.]

*Cystitis*.—Inflammation of the bladder.

*Cystoscope*.—An instrument for examining the interior of the bladder by means of a tube and electric lamps.

*Extravasation of Urine*.—The escape of urine through a rent in the urine passages or bladder wall into the surrounding parts.

*Lithotrity*.—The crushing of a stone in the bladder by means of a specially-constructed instrument (*lithotrite*).

*Pelvis*.—The girdle of bones at the lower part of the trunk, to which the spine is attached above and the thighs below. [Figs. 202, 203.]

*Pelvic Cavity*.—The space surrounded by the bones of the pelvis.

*Pēritōnēum*.—The membrane which lines the whole of the inside of the abdomen, and is wrapped around the intestines, etc. [Figs. 150, 151, 152.]

*Pēritōnēal Cavity*.—The cavity enclosed by the peritoneum.

*Pēritōnītis*.—Inflammation of the peritoneum.

*Prōstate*.—A large gland which surrounds the neck of the bladder. It often becomes enlarged in old men, and becomes an obstruction to the passage of urine along the urethra. [Figs. 12, 13, 14, 15.]

*Pūbic Bones*.—These form a portion of the pelvis, lying at the

lower part and in front. The bladder lies immediately behind them. [Figs. 12, 202, 203.]

*Stricture.*—A contraction or narrowing of any canal such as the water-pipe, urethra.

*Ūrēters.*—The two passages or tubes leading from the kidneys to the bladder. [Fig. 129.]

*Ūrēthra.*—The tube for urine, etc., leading from the bladder to the end of the penis. [Figs. 12, 13.]

### Anatomy.

The urinary bladder is situated in the pelvis, and when empty is protected from injury by the bony walls of that cavity. When very full it rises out of the pelvis, and its summit may be felt above the pubic bones in front. [Figs. 12, 13.]

The bladder has an average capacity of about 1 pint.

Through the posterior wall of the bladder pass the two ureters, the tubes which conduct urine from the kidneys to the bladder. From the lowest part of the front wall of the bladder opens the urethra, the tube which conducts the urine from the bladder out of the body. The urethra also serves the purpose of a conduit for semen. (See Genital Organs—Male, p. 390.)

The bladder is composed mainly of strong muscle, and is lined by a soft skin, the mucous membrane. When the bladder is empty its walls are in contact. The bladder lies entirely outside the peritoneal cavity, and is completely shut off from the intestines by the peritoneum. The peritoneum is firmly attached to the back (posterior aspect) of the bladder over about half of its extent.

### Injuries to the Bladder.

(i.) **Rupture or Puncture of the Bladder.**—The only serious, immediate consequence of injury to the bladder is the escape of urine into the tissues outside the bladder. This is the inevitable result of rupture of the bladder, whether due to crushes, wounds from sharp instruments, or bullet-wounds. The most common causes of rupture of the bladder are crushes of the pelvis in machinery accidents, and from being run over by vehicles.

The immediate gravity of the results depends upon whether the rent in the bladder occurs through that part of the wall of the bladder which is covered by the peritoneum, or that part which is not in contact with that membrane. In the first case the urine escapes into the abdominal cavity amongst the

intestines, and in the second instance the escape of urine is limited to the pelvis entirely outside the peritoneal cavity. The immediate results are far more serious in the first case, as peritonitis is an almost inevitable consequence. In the latter case it is not so.

The bladder may be ruptured, and urine escape from it into the surrounding parts without the infliction of any external wound, as in crushes, blows upon the lower part of the abdomen when the bladder is full, and in cases of fracture of the pelvis, where the broken bones may penetrate the wall of the bladder. It is stated that spontaneous rupture of the bladder may occur in old men the subjects of enlarged prostates, who often have great distension of the bladder with considerable thinning of its walls. The rupture is said to occur during great straining efforts to pass urine. The writer has never seen a case of this nature. In every case where an opening has been made in the bladder, whether by crushes, bullet-wounds, or blows upon the abdomen, immediate operation is the only course to pursue.

(ii.) **The Introduction of Foreign Bodies into the Bladder.**

—This is usually an injury which takes place during drunkenness, and is either self-inflicted as a frolic, or as an offence committed upon a drunken man by others.

In the case of hysterical women and men, and in insanity, the introduction of foreign bodies into the bladder is a not uncommon occurrence. Foreign bodies may be found in the bladder, having been introduced into the water-pipe by men for the relief of stricture. Amongst curious objects introduced for one or other of these purposes, the writer can mention metal and wooden meat skewers, the horn stem of a tobacco-pipe, stems of grass and corn, hairpins, long wax tapers, and a variety, indeed, of other objects which one would hardly conceive possible of introduction.

The immediate effects of the introduction of such dirty objects is intense irritation of the bladder, progressing to inflammation and its subsequent effects. (See below, Disease.)

### Disease.

1. **Produced by the Accident.**—Rupture of the bladder and the operation necessary for its relief may leave behind a varying degree of deformity, which may to some extent interfere subsequently with the power of emptying the bladder. A chronic inflammation of the bladder may remain after the

wounds have healed, and in some cases may give rise to the formation of stone in the bladder (calculus). [Fig. 16.]

Extravasation of urine into the abdominal cavity may cause adhesions to form amongst the coils of the intestine, due to the peritonitis set up by the extravasated urine. Such adhesions may subsequently give much trouble by causing pain, and even obstruction of the bowels. (See Abdomen, Intestines, Peritoneum, etc.)

Usually, however, if the patient recovers from so serious an accident as is necessary to cause rupture of the bladder, he is very little the worse for the illness he has passed through.

The introduction of dirty foreign bodies into the bladder sets up an inflammation of the lining membrane (cystitis) of greater or less severity, according to the length or shortness of the time the foreign body remains in the bladder. If allowed to remain some time, the foreign body becomes the nucleus of a stone which is formed around it.

The inflammation tends to spread, and may ascend the passages from the bladder to the kidneys (the ureters), setting up a particularly dangerous inflammation of the kidneys, to which the patient may succumb.

A urinary fistula or a communication between the bladder and surface of the body or back passage may persist after injuries, and require operation.

**2. Existing before the Accident and aggravating its Effects.**—As is the case in injuries to the genital organs, the diseases most seriously affecting the results of accident to the bladder are—

Diabetes mellitus.

Gonorrhœa.

Tuberculosis.

Syphilis.

Any injury to the bladder occurring in a patient the subject of diabetes is liable to be followed by a most serious, and often fatal, inflammation. If the patient has gonorrhœa at the time of the accident, the gonorrhœal infection is very likely to attack the injured bladder.

Patients suffering from tuberculosis and syphilis do not show the same power of recovery as healthy individuals, and their convalescence is likely to be very prolonged.

(For enlarged prostate, see Generative Organs, Male, p. 399.)

### Operation.

In the case of rupture or puncture of the bladder, immediate operation is necessary. The bladder must be carefully sewn up, and all the extravasated urine washed from the tissues around the bladder.

Foreign bodies must be removed with as little delay as possible, for the longer they remain the greater is the inflammation caused, and the more the probability of a stone forming round them.

### Cure.

If operation is undertaken at once, ruptures or wounds of the bladder usually heal readily, but the accidents of which these form a usual complication—viz., fractures of the pelvis—are usually so extensive that convalescence is prolonged far beyond the time necessary for healing the bladder.

Prompt removal of foreign bodies from the bladder is usually followed by rapid cure, but if severe inflammation of the bladder (cystitis) has arisen, complete recovery may be very tedious, lasting over many months, and in some cases may never be complete.

### Return to Work.

It is impossible to lay down a rule for this. Each case must of a necessity be a law to itself. If a ruptured bladder is operated upon without delay, the time for cure may be as short as three weeks, and the patient's return to work in about another three weeks.

### Recurrence.

Chronic inflammation of the bladder due to accidents may persist indefinitely; may appear to clear up and then relapse; and if stone has formed and has been removed, stone will frequently form again if the chronic inflammation persists. Such cases are, however, extremely rare, for in most cases nowadays operation is undertaken at once, and the patient generally either recovers completely or succumbs to the severity of the injuries he has received in the accident.

### Occupation Diseases.

There are no special diseases of the bladder caused by particular occupations.

### Diagnosis.

Wounds and ruptures of the bladder, when unaccompanied by external wounds, are sometimes difficult to diagnose at once; but the signs of extravasation of urine appear in a very few hours, and are quite unmistakable.

Foreign bodies in the bladder may be detected by the use of the instruments used for crushing and evacuating stones, or by the illumination and inspection of the interior of the bladder by means of the electric cystoscope.

### Malingering.

It is impossible for a patient to simulate rupture of the bladder without immediate detection by a medical man.

The attribution of pain, chronic inflammation, or stone in the bladder to a precedent accident must be judged in each case by the history of the accident, the nature of the operation performed, if any, and the character of the condition generally. The services of a surgeon expert in diseases of the urinary system will be essential in such cases.

### Criminal and Self-inflicted Wounds.

Stabs in the lower part of the abdomen may injure the bladder if it is full at the time. The writer is not aware of any recorded cases of self-inflicted injuries of the bladder other than by the passage of foreign bodies into it.

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*For legal cases of injury to the Bladder see CASE GUIDE: Bladder.*

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## BLOOD, BLOODVESSELS.

*See* VESSELS—ARTERIES AND VEINS.

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## BLOOD-POISONING.

*See* INFECTION AND PTOMAIN-POISONING.





FIG. 17.—LONGITUDINAL SECTION OF THE HEAD OF THE FEMUR, SHOWING STRUCTURE OF BONE.

A, Cancellous or spongy tissue; B, compact tissue.  
(From Buchanan's "Anatomy.")

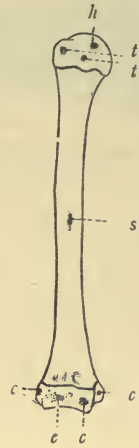


FIG. 18.—DEVELOPMENT AND GROWTH OF BONE: HUMERUS, SHOWING THE CENTRES OF OSSIFICATION, OR GROWTH.

*h, t, t*, Centres for the head, forming the upper epiphysis; *c, c, c, c*, the centres for the lower end, forming the lower epiphysis; *s*, the centre for the shaft. Between the shaft and upper and lower ends is a dark line—the epiphyseal line or cartilage.  
(From Buchanan's "Anatomy.")

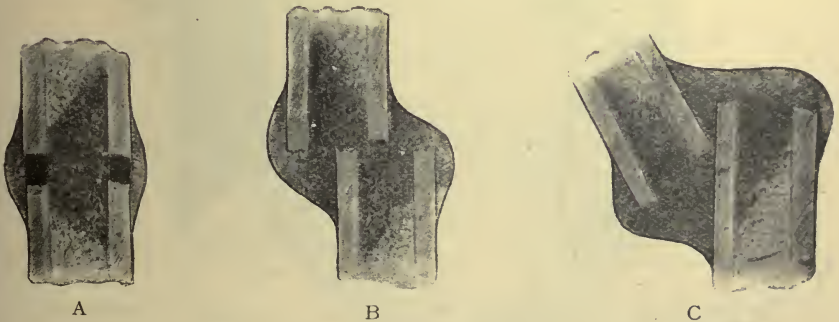


FIG. 19.—UNION OF BONE

A, The broken ends in close apposition with the uniting callus, forming a surrounding bond of union. B, The broken ends in imperfect apposition. C, The ends are not in apposition. (Note the large quantity of callus.)

(From Rose and Carless's "Surgery.")



FIG. 20.—ONE FORM OF VICIOUS UNION.  
The bone is united at a bad angle.  
(From Rose and Carless's "Surgery.")



FIG. 21.—DIAGRAM OF NECROSIS, OR DEATH, OF LARGE FRAGMENT OF SHAFT OF BONE, AND CONSEQUENT FORMATION OF A SEQUESTRUM, OR PIECE OF DEAD BONE RETAINED WITHIN THE BONE-SHEATH.

A channel, or sinus, communicates with the surface on each side.

(From Rose and Carless's "Surgery.")

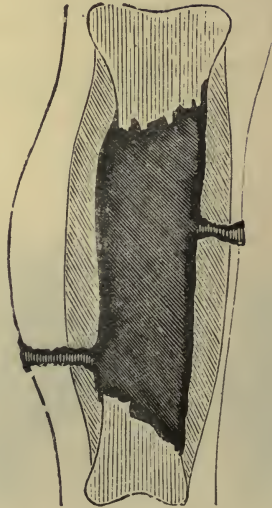


FIG. 22.—THE SAME CONDITION AS SHOWN IN FIG. 21, AFTER THE REMOVAL OF THE PIECE OF DEAD BONE.

The thin bony walls of Fig. 21 are enormously thickened, and contain an unhealthy cavity.

(From Rose and Carless's "Surgery.")

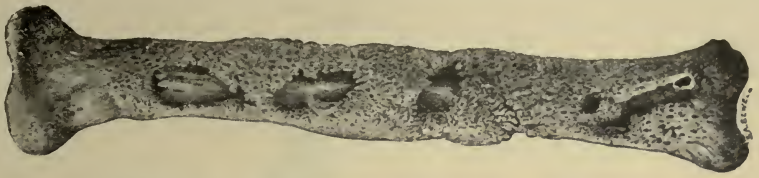
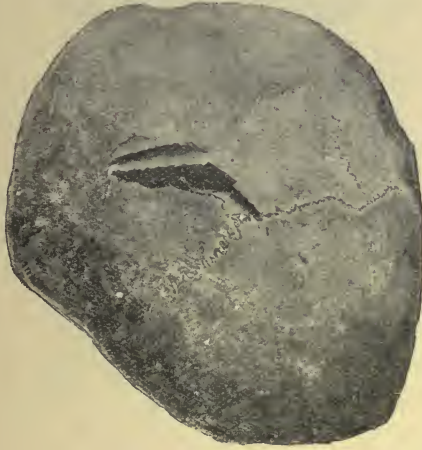
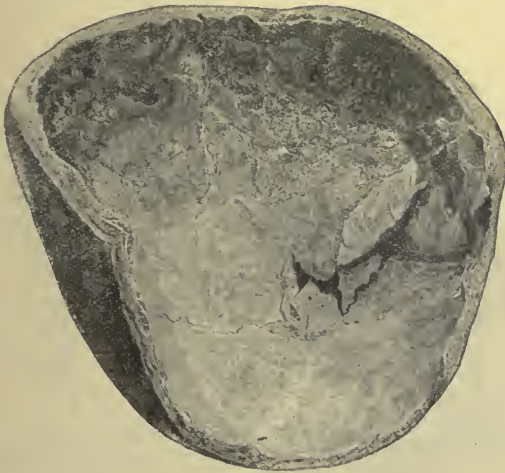


FIG. 23.—NECROSIS AND SEQUESTRUM: DEAD BONE ENSHEATHED IN AN UNHEALTHY CASING OF IRREGULAR NEW BONE, CAUSED BY INFLAMMATION OF THE BONE.

(From Rose and Carless's "Surgery.")



A



B

FIG. 24.—FISSURED AND DEPRESSED FRACTURE OF SKULL.

A, The size of the wound on the external surface. B, The inside of the same bone, showing the greater amount of damage done to the inner table of the skull.

(From Rose and Carless's "Surgery.")

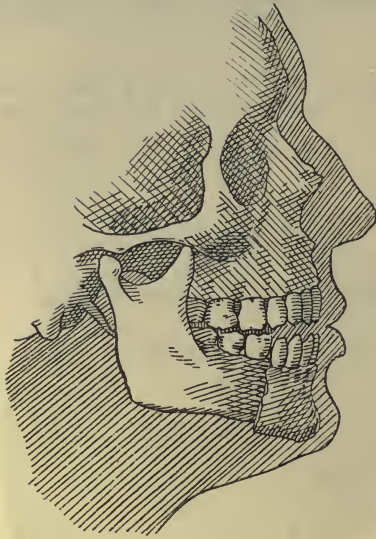


FIG. 25.—FRACTURE OF LOWER JAW

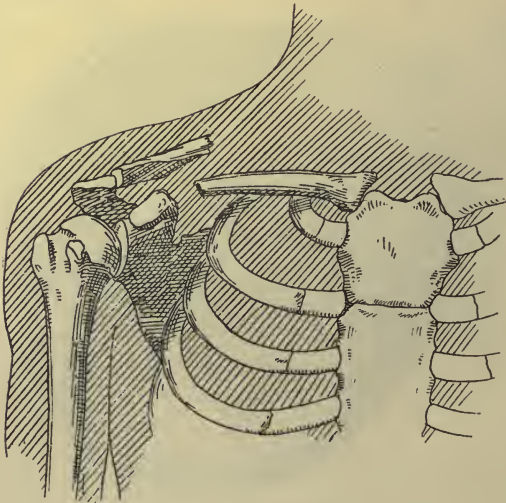


FIG. 26.—FRACTURE OF COLLAR-BONE (CLAVICLE).

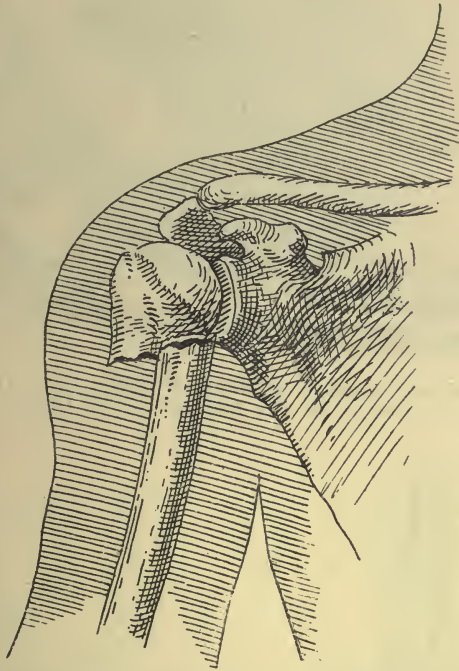


FIG. 27.—UPPER ARM: FRACTURE OF SURGICAL NECK OF HUMERUS.

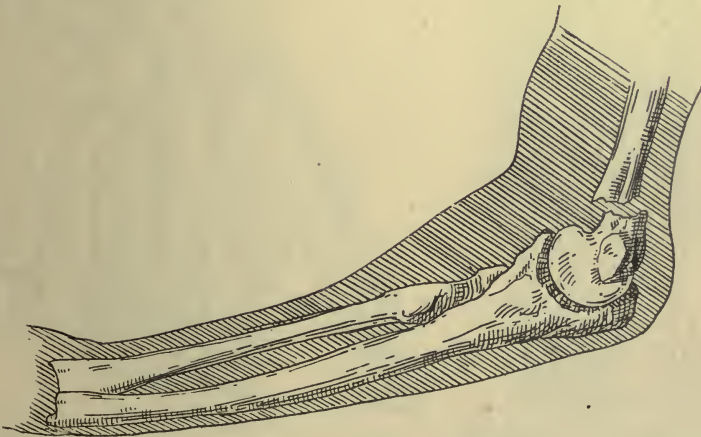


FIG. 28.—UPPER ARM: FRACTURE OF LOWER END OF HUMERUS.



FIG. 29.—FOREARM: FRACTURE OF THE END OF THE ULNA; BREAKING OFF OF THE OLECRANON PROCESS OF THE ULNA.

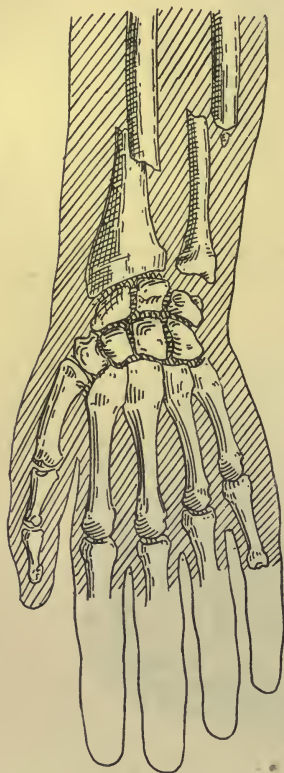


FIG. 30.—FOREARM: FRACTURE OF BOTH BONES, RADIUS AND ULNA, ABOUT THEIR MIDDLE.

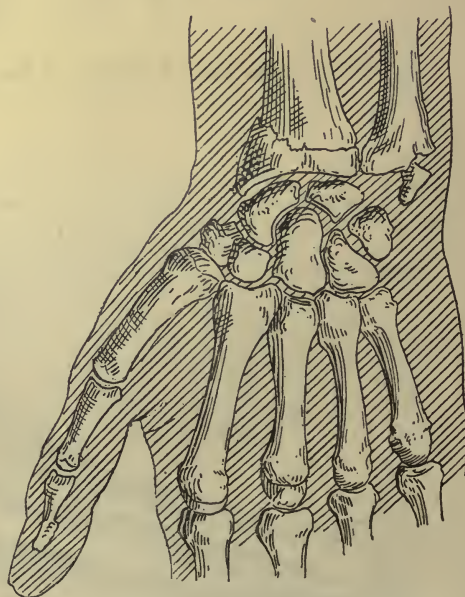


FIG. 31.—FOREARM: COLLES'S FRACTURE. The lower end of the radius and the tip of the ulna, called the "styloid process," are broken.



FIG. 32.—WRIST : FRACTURE OF ONE OF THE SMALL BONES OF THE WRIST (SCAPHOID).

(From Rose and Carless's "Surgery.")



FIG. 33.—THIGH : FRACTURE OF THE UPPER END, OR NECK, OF THE FEMUR (THIGH-BONE).



FIG. 34.—THIGH : FRACTURE OF THE MIDDLE OF THE FEMUR (THIGH-BONE).



FIG. 35.—KNEE: FRACTURE OF THE KNEECAP (PATELLA).

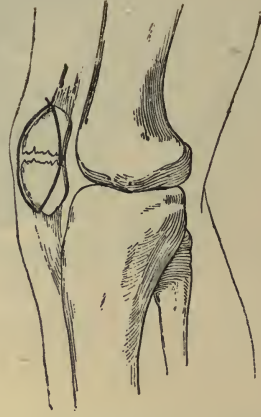


FIG. 37.—OPERATION: REPAIR OF BROKEN BONES—KNEECAP (PATELLA) WIRED.

The wire is left in the bone for a time which varies with the method of treatment adopted by the surgeon.  
(From Rose and Carless's "Surgery.")

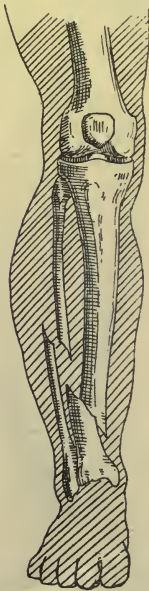


FIG. 36.—LOWER LEG: FRACTURE OF BOTH BONES OF THE LOWER LEG, TIBIA AND FIBULA, BELOW THE MIDDLE.



FIG. 38.—LOWER LEG: POTT'S FRACTURE—FRACTURE OF LOWER THIRD OF THE SMALL BONE (FIBULA), AND THE LARGE BONE (TIBIA) HAS ITS LOWER END (INTERNAL MAL-LEOLUS) BROKEN OFF.



# BONES.

By PERCY SARGENT,

M.A., M.B., B.C. (CANTAB.), F.R.C.S.

Surgeon to the National Hospital for the Paralyzed and Epileptic, Queen Square;  
Surgeon to Out-Patients, St. Thomas's Hospital.

## Head-note.

THE possible consequences of injury to bones may be considered under three heads :

1. Permanent deformity.
2. Concomitant injury to neighbouring structures — joints, tendons, nerves—or to any of the parts of the body normally protected by the bones injured, such as the brain in fractures of the skull.
3. Diseases set up by the accident and affecting the damaged bone and neighbouring tissues.

## Technical Terms.

*Ankylōsis.*—The condition of stiffness of a joint, the result either of injury or disease, whereby the movements are more or less limited or entirely prevented. The ends of the bones forming the joint become fixed together either by connective tissue (fibrous ankylosis) or by bone (bony ankylosis).

*Artery, Nutrient.*—See Nutrient Artery.

*Articular Cartilage.*—The smooth covering of the ends of bones which play upon one another at a joint.

*Articular Surface.*—The part of the bone under the articular cartilage.

*Atrophy.*—The process whereby a bone becomes lighter, less dense, and more brittle, due to disease, disuse, or old age.

*Callus.*—The material formed around an injured bone during the process of repair. (See Anatomy—Union of Fracture.) [Figs. 19, 20.]

*Cancellous Tissue.*—The spongy bone which fills up the ends of the long bones and the interior of the short and flat bones. [Fig. 17.]

*Carcinōma*.—A form of malignant disease included under the term "cancer."

*Càries*.—Absorption of bone by a gradual process of destruction.

*Cartilage*.—See Articular Cartilage and Epiphyseal Cartilage.

*Cellulitis*.—Inflammation of the connective tissue which lies beneath the skin, between the muscles, etc.

*Centre of Ossification*.—See below, Anatomy—(c) Development and Growth of Bones. [Fig. 18.]

*Colles's Fracture*.—See below, Fracture. [Fig. 31.]

*Comminuted Fracture*.—See below, Fracture.

*Compound Fracture*.—See below, Fracture.

*Complicated Fracture*.—See below, Fracture.

*Compact Tissue*.—The dense bone which forms the greater part of the shafts of long bones, and of the outer shell of flat and small bones. [Fig. 17.]

*Cōndyle*.—See Tuberosity.

*Depressed Fracture*.—See Fracture.

*Embōlism*.—The plugging of an artery by a fragment of blood-clot, or occasionally of fat, leading to arrest of the circulation in the district supplied by the artery. When this accident occurs in the lung, it is spoken of as pulmonary embolism. [Figs. 194, 195.]

*Ēpiphysis*.—Portions of bone developing separately during growth, and uniting when growth is complete with the main part of the bone. (See Epiphyseal Cartilage.) [Fig. 18.]

*Ēpiphysal Cartilage*.—The non-bony structure (cartilage) between the main body of the bone and the epiphysis; in this growth takes place. (See below, Anatomy—(c) Development and Growth of Bones.) [Fig. 18.]

*Fibrous Union*.—The repair of a fracture by fibrous connective tissue instead of bone.

*Fissured Fracture*.—See Fracture.

*Fracture*.—The following descriptive terms are applied to fracture:

(a) *Colles's*.—The commonest form of fracture occurring at the wrist (lower end of radius). [Fig. 31.]

(b) *Comminuted*.—The bone is broken into more than two pieces.

(c) *Complicated*.—Fracture of the bone is complicated with injury to other parts. (See below, Consequences of Accident.)

(d) *Compound*.—There is a communication between the broken bone and the exterior. In simple fracture there is no such communication as there is in compound fracture.

(e) *Depressed*.—Indicates that the separated portion of bone has been driven inwards, so as to occupy a deeper level than the rest of the bone. [Fig. 24.]

(f) *Fissured*.—A mere crack in a bone without displacement.

(g) *Greenstick*.—An incomplete fracture across the shaft of a long bone which is imperfectly ossified. It occurs in childhood

and in rickets, and resembles the incomplete breaking of a green stick. [Fig. 60.]

(h) *Impacted*.—One portion of the broken bone is driven into and remains fixed in the other.

(i) *Pott's*.—The commonest form of fracture occurring at the ankle. [Fig. 38.]

(j) *Simple*.—A break of bone without any communication between the broken ends and the exterior or surface of the body.

(k) *Spontaneous*.—A term etymologically incorrect, but often used to denote a fracture caused by violence, acting upon a diseased bone, which would be insufficient to produce the same fracture in a normal bone. The correct term is "pathological." (See below, Disease.)

(l) *Ununited*.—See below, Ununited Fracture.

*Gangrene*.—Mortification or death of visible portions of tissue. The corresponding process occurring in bone is spoken of as necrosis. (See *Gangrene*.)

*Greenstick Fracture*.—See Fracture. [Fig. 60.]

*Gümma*.—An inflammatory mass due to tertiary syphilis.

*Hýdátid*.—A stage (passed within the human body) in the life-history of a certain tape-worm which, in its fully developed condition, inhabits the dog's intestines. Common in Australia and New Zealand.

*Impacted Fracture*.—See Fracture.

*Mědulla*.—The fatty tissue, or marrow, which occupies the interior of bones.

*Necrōsis*.—Death of bone in fragments large enough to be visible to the naked eye. [Figs. 21, 22, 23.]

*Nutrient Artery*.—The main artery supplying the interior (marrow) of a long bone. Chiefly of importance during development.

*Ossification, Centre of*.—See Centre of Ossification. [Fig. 18.]

*Ōsteo-arthritis*.—A disease of joints characterized by degeneration of all the structures entering into their formation, and most commonly occurring in persons past middle life. Also called "rheumatoid arthritis." [Fig. 127.]

*Ōsteomyelitis*.—Inflammation of the medulla, or bone-marrow.

*Ostitis*.—Inflammation of the bony substance proper.

*Periosteum*.—The membrane or sheath covering the bone, which carries the bloodvessels to the bone, and from which new bone can be formed and laid down.

*Pěriōstitis*.—Inflammation of the periosteum.

*Pleura*.—The membrane lining the chest and covering the lungs.

*Pott's Fracture*.—See Fracture. [Fig. 38.]

*Pus*.—The fluid matter formed as the result of septic inflammation (suppuration).

*Pýæmia*.—A form of blood-poisoning. Characterized by the

presence of fragments of infected blood-clot in the circulation. Wherever such a fragment lodges, inflammation is set up, and an abscess may form. The main feature is the formation of multiple abscesses in different parts of the body. (See Infection, p. 448.)

*Rarefaction*.—The process of absorption whereby a bone is rendered less dense, the spaces within it being enlarged.

*Rheumatoid Arthritis*.—A synonym for osteo-arthritis.

*Sarcōma*.—A form of "cancer."

*Sclerōsis*.—The process whereby a bone becomes denser and heavier. The converse of rarefaction.

*Septicæmia*.—A form of blood-poisoning. Characterized by the presence of micro-organisms in the blood. The disease is only recognizable with certainty by a bacteriological examination of the blood. (See Infection—Septicæmia, p. 447.)

*Séquèstrum*.—A piece of dead bone. [Figs. 21, 22, 23.]

*Suppuration*.—The formation of matter (pus).

*Synōvial Fluid*.—The lubricating fluid of a joint.

*Thrombōsis*.—Clotting of blood in a living vein or artery. [Fig. 194.]

*Trōchānter*.—See Tuberosity.

*Tuberosity, Process, Trochanter, Condyle*.—Names given to prominent parts of bones, which serve for the attachment of muscles, tendons, and ligaments.

*Ununited Fracture*.—A fracture which has remained ununited at a period after the injury when union should have taken place. (See below, Consequences of Accident.)

*Vicious Union*.—The union of two ends of a broken bone at a bad angle, instead of being more or less in a straight line; or the union, after a fracture, of two adjacent bones, such as the two bones of the forearm (radius and ulna). [Fig. 20.]

### Anatomy.

The following parts of bones may be injured :

The shafts of the long bones of the limbs.

The ends of the bones near the joints.

The non-bony growing portion between the shaft and the extremity before development is complete.

The membranous covering of the bone.

The neighbouring joints, tendons, nerves, bloodvessels and subjacent organs.

Here we will consider bones with regard to—

(a) Structure.

(b) Shape.

(c) Development and growth.

(d) Displacement in fractures.

(e) Mode of union.

(a) **Structure.**—With very few exceptions, the bones consist of a dense outer shell which varies greatly in thickness in different bones, and even in different parts of the same bone, enclosing a space which is occupied by a sponge-like network of bone, the meshes of which are filled with marrow. The shell is called “compact tissue,” and the network “cancellous tissue.” In the shafts of the long bones the amount of cancellous tissue is reduced to a minimum, leaving a single large space filled with marrow, termed the “medullary cavity.” The short bones and the ends of the long bones are completely occupied by “cancellous tissue.” [Fig. 17.]

The outer shell is covered with a highly important membrane called the “periosteum,” from which the blood-supply to the bone is derived, and which is capable, when injured or inflamed, of laying down new bone, as, for example, in the healing of a fracture.

The interior of a long bone is supplied with blood chiefly by means of a special vessel termed the “nutrient artery”; but this is of little importance in the fully developed bone. It has been taught that damage to the nutrient artery in a fracture would retard the union of the fragments, but this theory has little or nothing to support it.

(b) **Shape.**—Bones are spoken of as long, flat, and short or cuboid.

A long bone consists of a shaft and two extremities. The extremities are shaped so as to be adapted to the contiguous bones, thus forming the joints. The part in contact with, and moving upon, the neighbouring bone at a joint is called the “articular surface,” and its covering the “articular cartilage,” a highly polished and extremely smooth dense substance which is lubricated with a fluid termed “synovial fluid.”

A flat bone is one shaped as its name implies, and is exemplified by the shoulder-blade and the bones forming the roof of the skull.

A short bone is small, of irregular shape, and is exemplified by the small bones of the wrist and ankle.

(c) **Development and Growth.**—With the exception of certain bones of the skull, the future bone of the adult appears in the unborn child (fœtus) as a lump or rod of cartilage.

In this appears, at a date varying with the individual bone, but fairly constant for any given bone, a gritty point known as the “centre of ossification,” from which the bony growth proceeds. [Fig. 18.] As the size of the body increases, the bones

become larger in circumference by a continual process of laying down of new bone by the membrane covering it (periosteum), whilst at the same time the more central part becomes absorbed, and so leaves the "medullary cavity." A long bone increases in length with the growth of the child, by the continual laying down of new bone at each end. The ends of long bones, generally speaking, are capped by a boss of cartilage, in which, at varying periods for different bones, centres of ossification appear. This boss is called the "epiphysis," and remains until growth is completed, separated from the shaft by a disc of growing cartilage termed the "epiphyseal cartilage." When the bone has reached its full length, the epiphyseal cartilage is converted into bone. [Figs. 17, 18.]

Long bones do not grow equally at both ends. As a rule one epiphysis remains separate from the shaft until a much later date than the other; consequently growth goes on longer from this end, which is termed the "end of greatest growth." Thus, whilst the upper arm bone (humerus) ceases to grow at its lower end at about seventeen years of age, at the upper end growth continues until about twenty years.

(d) **Displacement of Fragments in Fractures.**—When a bone is broken, the pieces occasionally remain in their normal relation to one another, being held together by an untorn bone-sheath (periosteum); but as a rule they are displaced from one another, producing the deformity characteristic of the injury. This displacement is brought about partly by the continuance of the force which produced the fracture, partly by the action of the muscles attached to the fragments, and partly by the leverage action exerted by the weight of the limb. Thus, in the common fracture through the "surgical neck" of the humerus [Fig. 27], the upper piece, close to the shoulder-joint, is drawn away from the chest (abducted) so as to form an angle with the rest of the bone below, and, being small and deeply placed, it is then very difficult to control. Thus, it happens that some amount of deformity, in spite of the most careful treatment, is apt to remain after the bone has united.

(e) **Mode of Union of Fractures.**—The fragments having been brought as nearly as possible into their natural relations with one another, and so held by splints (the so-called "setting" of the fracture), an active process of repair commences. At first a certain amount of blood-clot occupies the area between the fragments; but this is soon absorbed and replaced by young connective tissue, termed "granulation tissue." After a while

this "granulation tissue" has lime salts deposited within it, when it is said to be "calcified," and this calcified tissue is termed "callus." The "callus" occupies the "medullary cavity" at the site of fracture and the space between the broken surfaces of the "compact tissue," and is also deposited beneath the torn bone-sheath (periosteum) around the bone, in much the same way as the solder is heaped up round the junction of two leaden pipes.

The greater the distance between the fragments, and the more the movement to which they are afterwards subjected, the greater is the amount of callus produced. Later the callus is replaced by true bone; any excess of callus is absorbed; the medullary cavity is re-established, and the bone gradually resumes its normal appearance, but nearly always with some degree of deformity. [Figs. 19, 20.]

### Consequences of Accident.

- (i.) Simple and uncomplicated fracture.
- (ii.) Compound fracture with its attendant dangers.
- (iii.) Complicated fracture.
- (iv.) Ununited fracture.
- (v.) Injury other than fracture, which may result in inflammation either of a destructive character or of such a nature as to produce new outgrowths of bone, with attendant possibilities.

*N.B.—For special fractures affecting particular bones, see below, Cure.*

(i.) **Simple or Uncomplicated Fracture.**—A bone may be broken by either direct or indirect violence (leverage). The fragments may remain in their normal relation with one another, so that no deformity results, or they may be displaced in various directions. Displacement involves the tearing of the sheath of the bone (periosteum). When the deformity has been reduced (the so-called "setting" of the fracture), soft structures, such as periosteum, fibrous tissue, or muscle, may remain lodged between the broken surfaces, and may be a cause of non-union. (See below, Ununited Fracture.)

(ii.) **Compound Fracture.**—This form of fracture occurs where a wound through the soft parts communicates with the break in the bone. It is made either by the projection of the broken bone outwards through the skin, or by the violence tearing directly inwards through the skin and flesh, and exposing

the break in the bone. As a rule, cases of the former kind are the less serious; generally speaking, this form of compound fracture will, if properly treated, run the same course as a simple fracture. But where the wound which communicates with the broken bone is made from without, spreading inflammation, abscess formation, and death of bone, are liable to be set up by the introduction of dirt and germs.

The more ordinary dangers attending a compound fracture are—

(a) *Death of Bone (necrosis)*.—Varying in extent from the death of a tiny flake of bone up to that of the greater part of the shaft of a long bone.

(b) *Callus*.—Excessive formation of callus is probable, and this may implicate nerves, joints, etc.

(c) *Inflammation*.—Spread of the inflammation to tendons, joints, etc.

(d) *Deformity*.—Excessive deformity, from the difficulty of securing proper apposition.

(e) *Poor Union*.—Delayed union or permanent failure of union.

(f) *Amputation*.—The necessity for amputation in severe cases arises either from the damage done at the time (primary amputation) or from the spread of inflammation afterwards (secondary amputation).

(g) *Disease*.—Onset of certain general diseases as resulting complications, such as pyæmia. (See below, Disease and Inflammation.)

(iii.) **Complicated Fractures**.—Fractures may be complicated by injury affecting—

(a) *Joints*.—Dislocation or other damage. (See Joints.)

(b) *Tendons and Ligaments*.—Rupture of tendons and ligaments. (See Joints.)

(c) *Subjacent Structures*.—Injury to subjacent structures. (See Brain, Abdomen, Lungs.)

(d) *Nerves*.—Injury to nerves is caused either by the ends of the broken bones, or by the same violence as that which produced the fracture, or by the nerves becoming pressed upon by the new bony material (callus) formed during the repair of the fracture. (See Nerves.)

(e) *Bloodvessels*.—The injury may produce obliteration of the main arteries, and this may be followed by gangrene, and necessitate amputation. Damage to the larger veins is rare, but injury to the smaller deep veins is very common, resulting



in their becoming blocked by the blood clotting in them (thrombosis). This is a fruitful source of prolonged incapacity, since the limb below the point of obstruction in the veins often becomes swollen and painful. (See Gangrene, p. 346; and Vessels.)

(iv.) **Ununited Fractures.**—There are three chief kinds of abnormal union :

(a) *Delayed Union.*—From some condition of constitutional debility (*e.g.*, starvation) or disease (*e.g.*, kidney disease), a fracture may fail to unite for a period beyond that which is usual for any given bone; nevertheless, the ultimate union may be just as good and secure as in any ordinary case. Or some local condition (*e.g.*, a paralyzed limb) may account for the fracture taking longer than usual to unite, although none of these circumstances of necessity delay union.

(b) *Fibrous Union.*—This is the commonest condition in ununited fracture, and is usually due to the interposition of fibrous tissue, muscle, etc., between the fragments. Complete fractures of the kneecap (patella), for instance, do not unite by bone unless operated upon, because the fibrous tissue in front of the bone becomes entangled between the fractured surfaces, and cannot be removed except by operation.

(c) *Non-Union.*—This is a rare condition, and apart from the occurrence of tumours, etc., at the site of fracture, the cause is not definitely known.

(v.) **Injury other than Fracture** (*e.g.*, **Bruising**).—Simple inflammation of bone (ostitis) or of its sheath (periostitis) may result from a blow or other similar form of violence. It is evidenced by pain, and possibly swelling, which persist for a week or two and end in complete recovery. It may, however, be followed by the formation of an abscess. (See below, Disease.)

Other local diseases of bone may follow an injury other than a fracture, in exactly the same manner as if the bone had actually been broken. (See below, Disease.)

### Disease.

I. **Produced by the Accident.**—(a) In the bone; (b) in the neighbouring parts; (c) in distant parts.

(a) **In the Bone.**—It is customary to speak of periostitis, ostitis, and osteomyelitis, according to whether the brunt of the inflammation falls upon the bone-sheath (periostitis), the bone-tissue proper (ostitis), or the bone-marrow (osteomyelitis); but it is rarely limited to any of these situations, and, as the

causes and effects are in all three cases essentially the same, it will be convenient to use only the term "ostitis" in this connection.

*Simple Inflammation of Bone (Ostitis).*—This has been referred to already as resulting from injury other than fracture. (See above.)

*Suppurative or Infective Ostitis.*—Inflammation accompanied by the formation of matter (pus) may be of any degree, and the resulting piece of dead bone (sequestrum) may be of any size. [Figs. 20-23.] This disease is caused by the access of micro-organisms to the injured bone either from without, following on a compound fracture, or from within, being carried by the blood-stream from an area of inflammation elsewhere in the body.

*Specific Ostitis (Syphilis and Tubercle).*—See below, Disease.

*Tumours.*—The influence of injury upon the formation of tumours of bone is so indefinite and uncertain that no importance can be attached to it from the medico-legal standpoint.

The question of sarcoma (a form of cancer) arising as the result of injury is a difficult one. Whilst there are a few recorded cases in which such growths appeared definitely to be the result of the injury, yet in most instances it is far more likely that the fracture has resulted from the presence of the sarcoma, which in its growth absorbs and weakens the bone.

Tumours associated with fracture are almost invariably the cause, and not the result, of the accident, in that they cause absorption and weakening of the bone. The bone may then break from some very trivial injury, such as turning over in bed ("spontaneous" fracture). (See below, Disease Existing before the Accident.)

(b) **In Neighbouring Parts.**—Infection may spread from a septic inflammation of bone, following compound fracture or other injury, to the—

1. *Muscles and Connective Tissues around:* causing widespread inflammation (cellulitis), with all its attendant dangers, such as blood-poisoning.

2. *Joints:* involving special risks. (See Joints.)

3. *Tendon-Sheaths:* resulting in destruction of the tendon, and entailing permanent stiffness from adhesions. (See Tendons.)

4. *Nerves:* producing pain, paralysis, etc. (See Nerves.)

5. *Veins:* resulting in clotting of the blood within them, and obliteration of the veins (thrombosis). Such a clot may

become detached and carried by the circulation to the lungs (embolism of lung, or pulmonary embolism). This is a very serious accident, and if the clot be a large one sudden death may result.

When the clot is infected, there is grave danger of that form of blood-poisoning known as pyæmia. (See Infection—Pyæmia, p. 448.)

6. *Brain and its Covering Membranes*: see Brain Nerves, etc.

7. *Lungs*: fractures of the ribs are not infrequently followed by pleurisy. This may be of so slight a nature as not appreciably to influence the course of the case; but it may be of a septic character, and give rise to an abscess within the chest (empyema). Such a complication constitutes a danger to life, and in any case it entails prolonged incapacity and probably permanent impairment of health. (See Lungs, p. 534.)

(c) **In Distant Parts.**—A simple fracture rarely causes constitutional disturbance of any severity.

*Lung*: (1) *Embolism.*—Occasionally there occurs a sudden blocking of an artery of the lung from blood-clot or fat carried to it by the blood-stream, from the fracture, causing difficulty in breathing of varying degrees of severity, and possibly a certain amount of permanent damage to the lung. Occasionally sudden death ensues.

(2) *Pneumonia.*—In the aged who are obliged to be kept in bed because of fractures to the lower limbs, a form of congestion of the lungs (hypostatic pneumonia) is apt to occur, and this, too, may prove fatal. (See Lungs—Secondary Disease, p. 537.)

*Nervous System.*—In the alcoholic a fracture frequently induces an attack of delirium tremens (traumatic delirium). (See Alcohol—Delirium Tremens, p. 57.)

*Blood-Poisoning.*—Compound fractures, if they become poisoned (septic), may give rise to various forms of blood-poisoning, namely, septic absorption, septicæmia, or pyæmia (see Infection), due to the entrance of poisons or of micro-organisms, at the site of the fracture, into the circulation. These diseases are attended with fever and other symptoms of a severe illness. Pyæmia is a disease characterized by high fever, shivering fits (rigors), and the formation of abscesses in other parts of the body, and is frequently fatal. Recovery may ensue after a prolonged illness; but the general health would then most probably be permanently impaired. (See Infection—Septicæmia, p. 447; Pyæmia, p. 448.)

*Tetanus.*—Occasionally the germs of lockjaw (tetanus) gain

entrance through a compound fracture. This disease is usually fatal, but there may be recovery. (See Tetanus.)

*Gangrene.*—When certain specific organisms gain an entrance by means of a compound fracture, a rapidly spreading form of gangrene, or mortification, may supervene. This may terminate fatally, or recovery may in favourable cases ensue after amputation of the affected limb, or even sometimes without amputation.

Sometimes even after amputation the disease continues to spread up the limb, necessitating a second or even a third operation. (See Gangrene, p. 346.)

**2. Disease Existing before the Accident and Aggravating its Effect.**—Certain diseases and constitutional conditions may influence either the occurrence of fracture, by rendering a bone more fragile, or the course of a fracture, by delaying its union. They are :

- (i.) Ages and constitutional disease.
- (ii.) Alcoholism.
- (iii.) Syphilis and tuberculosis.
- (iv.) Nervous diseases.
- (v.) Malnutrition.
- (vi.) Tumours, etc., producing “spontaneous” or pathological fractures.
- (vii.) Lung diseases.
- (viii.) Osteo-arthritis.

(i.) *Age.*—Whilst it is generally admitted that the bones in old age are more brittle than in young adult or middle life there is no evidence to prove that they unite either less readily or less firmly. The results of a fracture, as of any severe injury, are more serious in the diseased than in the healthy, and in the aged than in the young. In the former the recuperative powers are less vigorous, and the ill-effects are likely to be prolonged.

(ii.) *Alcoholism.*—Except for greater frequency of exposure to injury, the alcoholic are not more liable to fractures than the healthy. Nor is there any ground for believing that their bones unite any less readily than those of healthy subjects. Union may, of course, be delayed on account of visceral disease, resulting from chronic alcoholic poisoning; and it is well known that alcoholic delirium, by rendering proper treatment difficult or impossible, both delays union and interferes with the obtaining of a good functional result. In the alcoholic a fracture often brings on an attack of delirium, and in this manner it may

be said to influence the course of chronic alcoholic poisoning. (See Alcohol—Delirium Tremens, p. 57.)

(iii.) *Syphilis*.—In a syphilitic person a slight or even trivial injury may result in the formation of a syphilitic inflammation of bone (gumma), which may lead to death of the bone (necrosis) in varying degrees. In a tuberculous person an injury may be followed by erosions (caries) about the ends of the long bones, leading to joint disease, caries of the spine or pelvic bones, or chronic abscess of bone. The tendency of syphilis, as it affects the shafts of long bones, is to render them more dense. Sometimes, however, a process of rarefaction takes place, which would tend to weaken the bone, and any extensive death of bone (necrosis), with loss of substance, would undoubtedly leave a weak spot. These are points which would be cleared up by an X-ray picture. A fracture, like any other bone injury, in the subject of active syphilis is apt to determine the formation of a local syphilitic manifestation (gumma); and this, unless promptly recognized and treated, would undoubtedly prolong the period of recovery.

(iv.) *Nervous Disease*.—The frequency of fractures, especially of the ribs, in the insane and in the subjects of certain nervous diseases has long been a matter of common knowledge. No doubt such patients, from being under conditions of necessary restraint, are more exposed to violence than are normal persons; yet it is generally agreed that there is in addition some change in the bones which renders them more liable to fracture from comparatively slight violence.

In the neurotic an injury not infrequently brings about an exaggeration of the neurotic state, causing any degree of neurasthenia.

Limbs which have long been paralyzed, as in infantile paralysis, are more prone to fracture, on account of the rarefaction and weakening of the bones.

(v.) *Malnutrition*.—Any cause of general malnutrition, and any other chronic debilitating disease, may, but does not necessarily, delay the union of a fracture. There is no evidence to show that the ultimate result is thereby affected. It is difficult to say exactly in what manner, in a general way, a fracture can influence the course of a constitutional disease save in lowering the body resistance from shock and confinement to bed.

(vi.) *Tumours, etc., producing Pathological or "Spontaneous" Fracture*.—Various local conditions render bones more liable to fracture, so that sometimes only the very slightest violence

is necessary. Hence such fractures are often termed spontaneous. Such conditions are—

(a) Tumours of bone, either primary or secondary sarcoma, or secondary carcinoma (cancer). In countries where hydatids are common, these cysts are sometimes the cause of pathological fracture. (See above, Technical Terms.)

(b) Chronic infective disease. Syphilis has already been referred to. Localized tuberculous disease rarely attacks the shaft of a long bone, but we have known a case where a fracture of the femur was brought about by this cause.

(c) Structural weakening of bone in limbs the joints of which have long been immovable (ankylosis). Cases of old cured hip disease with ankylosis are specially liable to fracture of the femur. No doubt this is in some measure due to the ease with which a leverage action is exerted upon the thigh; but it is also partly due to alteration in the structure of the bone consequent upon changes in the direction of the pressure and traction forces upon which the architecture of a bone depends.

(d) Rare conditions of disease, such as the so-called “*fragilitas ossium*” (of which little is known) and “*mollities ossium*,” or osteomalacia, predispose to fracture and to delay in union.

(vii.) *Lung Diseases*.—In the subjects of chronic bronchitis, the necessity for recumbency after a fracture often determines the onset of pulmonary complications, which may even terminate fatally. (See Lungs—Secondary Disease, p. 537.)

(viii.) *Osteo-Arthritis (Rheumatoid Arthritis)*.—In persons past middle age a fracture in the neighbourhood of a joint frequently determines the onset of osteo-arthritis, or rheumatoid arthritis. (See above, Technical Terms.) This is especially liable to occur with fractures of the neck of the femur and about the upper end of the humerus. It would, however, be difficult to prove the extent of the influence of the injury on the disease, as there may have been some unnoticed osteo-arthritic changes antecedent to the accident, and the case then may be one of pre-existent disease made worse by injury, and not of disease arising *de novo* as the direct result of the injury. [Fig. 127.]

### Operation.

The operations required owing to injuries to bones must be considered under the following headings :

- (a) Injured but unbroken bones.
- (b) Simple uncomplicated fractures.

- (c) Compound fractures.
- (d) Fractures complicated by injury to neighbouring important structures.
- (e) Faulty union of fractures.

(a) **Injuries to Bone other than Fracture.**—An inflammation of bone which leads to the formation of an abscess necessitates the opening of the abscess, and in nearly every case a second operation at a later date for removal of a piece of dead bone. The risks of these operations are trivial.

A chronic inflammation of bone with thickening (sclerosis) may require the operation of chiselling away portions of bone for the relief of persistent pain. For when a bone becomes more dense, its minute canals become narrowed, and the contained nerves are then pressed upon. This operation, too, is practically devoid of risk.

If tuberculous disease supervenes upon an injury, the consequence as regards operation may be far-reaching. For example, tuberculous disease of the spine following an injury to the back may require repeated operations for the opening of abscesses or for the removal of dead bone.

(b) **Simple Uncomplicated Fracture.**—Many fractures of the limbs require "setting" under an anæsthetic. In the broader sense this constitutes an "operation." Its only risks are those of the anæsthetic. (See Anæsthetics.)

There are some simple fractures which, if the best possible result is to be attained, should be treated by open operation.

*Kneecap and Elbow.*—In the case of the patella (kneecap), it is universally admitted that the wiring together of the broken fragments is the only possible way of securing bony union, and consequently a strong limb. [Fig. 37.] Similar arguments hold good for fractures of the olecranon (the point of the elbow). Modern surgical methods have rendered these operations practically devoid of risk, but there is a small number in which, in spite of all proper care, suppuration (abscess formation) and acute inflammation of the joint occur. When this happens the consequences are extremely serious. The best that can be hoped for is recovery with a stiff joint, but often amputation becomes necessary, and sometimes death ensues.

A few surgeons hold that many more simple fractures should be wired or screwed than are usually operated upon, and consider that better functional results are thereby attained. The chief instance is Pott's fracture, which is a partial dislocation of the ankle-joint accompanied by fracture of the lower end of the

fibula (narrow outside bone of the leg). [Fig. 38.] Whether this common fracture should be operated upon or not is a matter of opinion. It is safe to say that the majority of surgeons hold that it only requires operation in exceptional cases (*e.g.*, a case inefficiently treated, with persistent deformity), and that with proper care a perfect result can be obtained without resorting to operative measures. Should a simple fracture be operated upon and become septic (*i.e.*, inflamed from the presence of micro-organisms), the patient incurs all the risks of a septic compound fracture. (See below.)

(c) **Compound Fractures** may necessitate the following operative procedures :

- (i.) Cleansing and "setting" under an anæsthetic.  
This is always necessary.
- (ii.) Reopening and drainage of the wound.
- (iii.) Incision of abscesses.
- (iv.) Removal of dead bone at a later date.
- (v.) Primary amputation in such circumstances as—  
Very severe crushes with extensive splintering (comminution) of bone and laceration of soft parts; extensive involvement of joints, tendons, nerves, etc.; obliteration of the blood-supply.
- (vi.) Secondary amputation for septic complications, mortification, or the onset of tetanus (lockjaw).
- (vii.) Wiring, screwing, etc., for faults of union or of position.

None of these operations are of themselves attended by any serious risk, except v. and vi. There is always a slight risk attending the administration of an anæsthetic, particularly if the patient is suffering from certain affections of the heart or lungs, or from certain constitutional diseases, or from serious concomitant injuries (*e.g.*, compound fracture of pelvis with abdominal contusion). (See Anæsthetics.) But all except vii. are operations of necessity, designed to relieve or avoid conditions of which the dangers are immeasurably greater than those of the operation. Amputation, whether primary or secondary, is apparently attended with a fairly high mortality, which, other things being equal, increases with the proximity of the site of amputation to the trunk. The reason for this is that nowadays amputation is only resorted to in the worst cases, many limbs being saved which would formerly have been removed, so that the rate appears higher than would be expected.



(d) **Complicated Fractures.**—Operation may be necessary—

(i.) To relieve pressure of displaced bone upon brain, spinal cord, nerves (see Nerves, p. 577), or to repair lacerated structures, as the urethra, bladder (see Bladder and Genital Organs—Male), abdominal organs (*e.g.*, the liver from fractured ribs), tendons, muscles, nerves, etc. (See Abdomen, Joints, Nerves, etc.).

(ii.) To relieve compression of a nerve. The nerve most often so involved is that which winds round the shaft of the bone of the upper arm (the musculo-spiral), from its implication in callus during repair of fracture of the humerus.

(iii.) To adjust displaced fragments when a joint is involved, in order to minimize subsequent interference with its movements.

(iv.) To replace a displaced epiphysis (a growing end of the bone), in order to prevent interference with growth of the bone. (See Children—Bones, p. 215.)

(v.) To arrest bleeding from an artery torn by the broken bone. The blood may escape externally, or may give evidence of its presence internally by pressing upon important structures (*e.g.*, brain), or by forming a large swelling (*hæmatoma*).

(vi.) Amputation for mortification (*gangrene*) resulting from obliteration of the circulation when main arteries have been damaged.

The remarks under (c) Compound Fracture apply equally to the risks of these operations.

(e) **Faults of Union.**—(i.) Removal of fibrous tissue, muscle, etc., from between the fragments when preventing bony union—*e.g.*, kneecap.

(ii.) Adjustment of small fragments which cannot be controlled by other means than by operation.

(iii.) Correction of deformities from union in faulty positions.

All the operations for faulty union, as a rule, require the use of wire, screw, or other mechanical devices, for holding the bony fragments in position. The risks as regards suppuration are slight; but if this does occur, then the dangers are the same as those of compound fracture. (See above.) Even apart from suppuration, the wires are apt to give rise to trouble, and require an operation for their removal at a later date. For example, a fractured kneecap is wired, everything goes on perfectly satisfactorily, and the patient returns to work. Some weeks or months later he finds that the wire, having become loose and movable, can be felt beneath the skin, and gives him pain. An operation for its removal then becomes necessary,

and, although trivial in itself, incapacitates him from work for about a fortnight.

### Cure.

It is highly important to distinguish between the time taken for repair of an injured bone, and the total period of incapacity. The latter (see next section, Return to Work) must depend largely upon the nature of the patient's occupation, and very largely upon the completeness of his submission to all the methods and means which he may be instructed to submit to, or to follow during convalescence. Thus, the necessary movements and rubbing of a recently fractured limb are often neglected by the humbler classes, and they generally fail to take the amount of exercise which they are told would expedite their recovery. For example, a fracture of the radius (one of the bones of the forearm) takes four or five weeks to unite; it will be another three or four months before the limb is completely restored and free from pain. But supposing only the left arm of a right-handed person to be involved, the total incapacity of a business man need not be more than a month, whereas a skilled mechanic or a labouring man would require the full period of four or five months before being able to resume full work.

In this section, therefore, only the strictly surgical aspect is considered; the periods of incapacity in different occupations, bearing upon the question of compensation, comes under the next heading (*i.e.*, Return to Work).

(A) **Simple Fractures.**—These are best dealt with under individual bones, and only the more common fractures of those bones will be described: (i.) Skull; (ii.) Spine; (iii.) Ribs and chest; (iv.) Pelvis; (v.) Arms and shoulders; (vi.) Leg.

(i.) **Skull.**—As regards the injury to the bones alone, recovery rapidly ensues. But these fractures are so commonly associated with damage to the brain and nerves that the period of recovery from the accident as a whole may be greatly lengthened. (See Brain.) In the following paragraphs such complications will be disregarded.

*Vault of the Skull.*—Probably many mere cracks (fissured fracture), especially those which only affect the inner layer of the skull (inner table), are not recognized. It is sometimes possible to diagnose them by means of the X rays. The time for recovery would not be more than a fortnight.

In fracture from direct violence the inner table is often more extensively damaged than the outer, so that an inspection of the surface of the skull may fail to reveal the full extent of the

injury to the inner table, and, consequently, to the underlying brain and its covering membranes. Such fractures more often than not require operating upon, and it may not be until the skull has been opened that the extent to which the inner table has been splintered can be made out.

Depressed fractures, whether causing symptoms of pressure upon the brain or not, require operation, lest in the future symptoms of irritation of the brain should arise. The operation is not a serious one, and recovery should be complete in three weeks. It should be noted that such an operation usually leaves a defect in the skull, which is never filled up by new bone, and that therefore the resulting condition might have a bearing upon fitness for particular kinds of employment. (See next section, Return to Work.)

*Base of the Skull.*—Fracture may be recognized by hæmorrhage from the nose or mouth, from the ear, or, if in the posterior part of the skull, by the appearance of bruising behind the ear a few days after the accident. Apart from complications, such injuries are rapidly recovered from.

*Bones of the Nose.*—These are dealt with in the chapter on the nose. (See Nose, p. 593.)

*Malar Bone (Cheek-Bone).*—Fracture of this usually results in depression of the fragment, and, in order to prevent subsequent deformity and interference with the movements of the lower jaw, an operation is commonly necessary. The period of recovery will be about three weeks.

*Lower Jaw (Mandible).*—It is only the uncommon forms of fracture of the lower jaw which are simple. The common fracture of the body of the jaw is almost always compound (*i.e.*, communicating with the interior of the mouth), because the closely adherent gum becomes torn. If no complications occur, such as necrosis or the formation of abscesses, healing becomes complete in four or five weeks. It is sometimes necessary to operate, and to wire the fragments if they cannot be controlled by splints or wiring of the teeth.

Frequently one or two teeth in the neighbourhood of the fracture are lost, a condition which, of course, is irreparable. [Fig. 25.]

(ii.) *Spine.*—Small pieces of the vertebræ are sometimes broken off without causing any symptoms of injury to the spinal cord or to the nerves. Such fractures are caused by direct violence, and are accompanied by bruising and laceration of the muscles and ligaments of the back. Although the

fracture will unite readily, as a rule, in the course of three or four weeks, or even less, yet it may take months before the patient is free from pain and has recovered the full flexibility of his spine.

Fracture in the neighbourhood of the apertures through which the nerves leave the spinal canal may involve those nerves either at the time of the accident or during repair, by pressure from the callus that is formed. For the course of such cases, and for fracture of the spine involving the spinal cord, see Nervous System.

(iii.) **Ribs and Chest.**—Fracture of two or three ribs, unaccompanied by injury to the subjacent structures, is, in the healthy, an unimportant accident. Union readily occurs, and cure should be complete in three or four weeks. Fracture of many ribs, especially in the old and the unhealthy, is, on the other hand, a very serious injury, even if uncomplicated by severe damage to the subjacent structures, and frequently proves fatal. If recovery occurs, convalescence may be retarded for many months, and the lung may be permanently affected from interference with its expansion. (See Lungs, p. 534.)

Running in a bony groove below each rib is a nerve called the intercostal nerve, which may be involved in the callus, and cause recovery to be delayed through pain.

*Sternum.*—Fracture is uncommon, and is usually produced by direct violence of a severe order. From the point of view of cure, the same remarks will apply as those made concerning fractured ribs.

(iv.) **Pelvis.**—Small portions of the pelvis are sometimes broken off by direct violence, particularly the prominence of the hip (iliac crest). Such an accident will usually be recovered from in five or six weeks, but, owing to the difficulty of keeping the fragment in position, some deformity generally results. In order to avoid this a wiring operation is sometimes resorted to, and this would not lengthen the period necessary for convalescence.

Fractures of the pelvis which run through the pelvic ring are sometimes accompanied by injury to the bladder or urethra (see Generative Organs—Male), and owe their importance to that cause. When very comminuted, operation may be necessary to replace the fragments, and occasionally wiring is advisable. In such severe cases a certain amount of deformity is almost certain to remain permanently, and some lameness is likely to persist, incapacitating the patient from following

any arduous employment. Apart from these very severe cases, and those in which some organ has been injured, fractures of the pelvis unite readily, and recovery is usually complete in a few weeks.

(v.) **Arm and Shoulder.**—(1) Collar-bone (clavicle); (2) humerus; (3) radius and ulna; (4) metacarpal bones; (5) fingers; (6) wrist.

1. The *Collar-Bone* (or the clavicle) is most often broken between the outer and middle thirds. [Fig. 26.]

Union usually becomes firm in four weeks. If the fracture has been complete, there is almost always some deformity and shortening; but even a considerable degree of deformity is not incompatible with a perfectly strong and useful limb.

The return of full use may be delayed by injury to the underlying vessels, causing swelling of the arm, or by pain and muscular wasting, the result of injury to the nerves of the limb.

2. The *Upper Arm* (humerus) is most often broken in one of the following situations:

(a) The surgical neck, or the place at which the upper end merges into the shaft. [Fig. 27.] Owing to the difficulty of retaining the fragments in position, some deformity is to be expected, but not sufficient to make any difference to the strength or usefulness of the arm. Union is firm in five or six weeks, but weakness and stiffness of the shoulder-joint are liable to persist for many weeks longer, so that the period for perfect recovery should be about four or five months.

In patients past middle life rheumatoid arthritis or osteo-arthritis changes—*i.e.*, roughening of the smooth cartilage of the joint—are liable to occur in the shoulder-joint, and in the aged perfect restoration of function is unlikely.

(b) Separation of the upper epiphysis. (Children—Bones, p. 213.)

(c) Anatomical neck. This is the line of junction of the head of the bone with the shaft, and fracture of this neck involves the head of the bone being quite loose in the shoulder-joint.

Sometimes the head of the bone is driven into the upper end of the shaft (impacted), in which case recovery with slight shortening of the arm will result in a few weeks. The fracture is more common in elderly people, and on this account the accident is often followed by osteo-arthritis changes in the joint, so that complete recovery is unlikely. If impaction does not take place, considerable interference with the movement of the joint will result, unless operation is performed

either to remove or to replace the detached head of the bone.

(d) The shaft. Fracture commonly occurs at about the middle of the shaft, and this is one of the common situations for non-union to occur, because of the liability of portions of muscle to become entangled between the broken ends. It is this fracture, too, which is most frequently complicated with a nerve injury, either at the time of the accident or by implication in callus during healing, the nerve concerned being the musculo-spiral. If neither of these complications occurs, the bone unites readily, union is firm in six weeks, and perfect use of the limb should return in another two or three months.

(e) The lower end. The fracture may take place more or less transversely immediately above, and frequently extending into the elbow-joint. [Fig. 28.] In children the lower epiphysis may be separated, producing a similar condition. Small fragments may be broken off from the lower end of the bone, the fracture then involving the joint. The time taken for cure of these accidents is nearly always much longer than that required for the actual union of the bone, which is from three to five weeks, because of the great difficulty in restoring properly the movements in the elbow-joint. Such fractures not infrequently require operation in order to restore and fix the fragments in position; but this does not lengthen the period of recovery unless matter formation (suppuration) should occur.

### 3. Forearm (ulna and radius).

(a) Olecranon. This portion of the ulna bone which enters into the elbow-joint, and which forms the prominence of the elbow, when broken, may or may not be separated from the rest of the bone. [Fig. 29.] In the former case the operation of wiring is required in order to secure firm bony union; otherwise fibrous union occurs, and the result is an arm permanently weaker, though in varying degrees, than before the accident. The time required for cure is from six weeks to two months. In elderly patients changes (rheumatoid arthritis) may subsequently occur in the joint, interfering permanently with full restoration of function.

(b) Colles's fracture. This is one of the most common of all fractures; it consists of an oblique fracture at about 1 inch above the lower end of the radius, accompanied frequently by fracture of the styloid process of the ulna. [Fig. 31.] It is occasionally impacted. Owing to the proximity of several tendons and their sheaths which pass over the broken bone, and to the

proximity of the wrist-joint, stiffness of the fingers and wrist may persist for many months. The method of treatment adopted influences the result of this, perhaps, more than any other fracture in the body. Bony union is firm in four or five weeks, but complete recovery cannot be expected in less than four months.

(c) Shafts of radius and ulna. Either bone may be broken alone or both together. [Fig. 30.] Union takes place in four or five weeks in any case, and full recovery should follow in about a month more. When the radius is broken, the full use of the arm is not regained quite so quickly as when the ulna alone is broken, because of the movements of turning the hand over backwards and forwards (supination and pronation), which depend so much upon the integrity of the radius.

4. *Metacarpal Bones*.—These occupy the main mass of the hand between the wrist and the fingers. They are not infrequently fractured, and such injuries are liable to be overlooked. The use of the hand should be perfectly restored in about six weeks after the accident.

5. *Fingers*.—When a joint is involved, there may be the utmost difficulty in restoring perfect function. Probably after such a fracture a certain amount of stiffness always results. If no injury has been done to the joint, union is firm in three weeks, and recovery complete in another fortnight or three weeks.

6. *Wrist*.—These not infrequently occur during manipulation of the starting handle of motor engines. The injury is produced either by the handle striking the ball of the thumb, or by flying round and striking the back of the wrist. There are three chief varieties of fractures of the wrist caused in this manner:

(a) Fracture of the scaphoid bone, one of the small bones of the wrist, with or without displacement of a fragment. [Fig. 32.]

(b) Cracks across the lower end of the radius, without displacement.

(c) Fracture of the radius just above the lower end.

The first two are diagnosable with certainty only by means of the X rays. They require about two months' treatment before cure is complete. The third comes under the heading of fractures of the shaft of the radius.

(vi.) *Leg*.—(1) The femur; (2) kneecap (patella); (3) tibia and fibula; (4) Pott's fracture; (5) foot.

1. *Femur*.—The chief fractures of this bone are those of the (a) neck; (b) shaft; (c) lower extremity.

(a) Neck. Fracture of the neck close to the head, within the

capsule or sheathing ligament of the hip-joint (intracapsular fracture), occurs chiefly in old people and from slight violence. It is almost invariably followed by fibrous union, with permanent shortening and weakness of the limb, and frequently by osteoarthritic changes in the hip-joint. The time for cure can scarcely be fixed, and most cases never recover beyond a certain point. The patient may, however, be able to get about, assisted by apparatus, in three or four months.

Fracture of the neck near the shaft (the so-called "extracapsular" fracture) is rather more favourable. [Fig. 33.] The time taken for recovery would be four to five months with or without operation, but usually a certain slight degree of shortening of the limb and lameness remain permanently.

Separation of the upper epiphysis. (Children—Bones, p. 213.)

(b) Shaft. The time taken for cure is usually about five months, although the bone should be firmly united in six or seven weeks. [Fig. 34.] A fairly accurate idea of the amount of shortening which will remain is given by the following table, compiled by Mr. E. M. Corner, from the St. Thomas's Hospital Reports, of 307 cases of fracture of the shaft of the femur :

22	per cent.,	or 68,	definitely stated to have had	no shortening after treatment.	
8	"	25	"	"	$\frac{1}{4}$ inch or under of shortening.
28	"	86	"	"	$\frac{1}{2}$ inch of shortening.
13	"	39	"	"	$\frac{3}{4}$ " "
17	"	51	"	"	1 " "
1	"	4	"	"	$1\frac{1}{4}$ inches of shortening.
5	"	14	"	"	$1\frac{1}{2}$ " "
2	"	7	"	"	$1\frac{3}{4}$ " "
3	"	9	"	"	2 " "
1	"	4	"	"	$2\frac{1}{4}$ " "

(c) Lower end. The chief fractures in this situation are transverse fractures immediately above, and sometimes running into, the joint; separation of the lower epiphysis before the age of eighteen; and fracture of either condyle separately. In all these union will be firm in six to eight weeks, but owing to the injury to the knee-joint complete recovery cannot be expected in less than four or five months; even then some permanent disability may affect the knee. (See Joints.)

2. *Kneecap (Patella)*.—The kneecap may be broken into several fragments without appreciable separation (stellate fracture). Such a fracture will heal readily, and the use of the limb will be restored in a few weeks. But the common fracture of the bone is one which passes transversely across



it, and is followed by a separation of the fragment that varies from  $\frac{1}{2}$  inch to 2 or 3 inches. [Fig. 35.] Such a fracture if treated without operation results in union by fibrous tissue, and this fibrous tissue in course of time is apt to become stretched, causing reseparation of the fragment and permanent weakness of the limb. If operated upon, bony union will take place, and the full use of the limb is regained in three or four months. [Figs. 35, 37.]

3. *Tibia and Fibula*.—The shafts of the two bones of the leg may be fractured separately, but are more frequently broken together. [Fig. 36.] The bones unite firmly in six or seven weeks, but full recovery is apt to be delayed for several weeks longer by wasting of muscles, stiffness of the ankle, and a tendency of the leg to become swollen after standing or walking. The ultimate outlook, however, as regards complete recovery is very favourable.

4. *Pott's Fracture*.—This consists essentially of a partial dislocation of the foot at the ankle-joint, accompanied by an oblique fracture of the lower end of the fibula, and associated with either fracture of the tip of the lower end of the tibia (internal malleolus) or rupture of the internal lateral ligament of the ankle-joint. [Fig. 38.] About six weeks are required for bony union, but complete recovery usually takes much longer than that, owing to the damage to the joint and the tendons which pass across it. The time for cure will usually be from four to five months.

5. *Foot*.—Fractures of the bones of the foot, except as the result of severe crushes (in which case they are usually compound or otherwise complicated), are not common. If slight in extent, only a few weeks are required for full recovery; but if at all severe, pain and lameness together with a certain amount of deformity may persist for a very long while.

(B) **Compound Fractures**.—The time for cure of a compound fracture can only be approximately given in general terms. Those in which no matter is formed—*i.e.*, no suppuration occurs—take no longer than simple fractures, and, in fact, run the same course. When suppuration occurs, a certain amount of death of bone (necrosis) is almost inevitable. The time taken for separation of the dead bone and healing of the wound is commonly a matter of several months, and, as a rule, the union of the fracture is considerably delayed. Moreover, the spread of the inflammation to neighbouring structures, the wasting of muscles from prolonged disuse, and the effects upon the patient's

general health, are all factors which play a part in delaying recovery.

To take a concrete example, a compound fracture of the tibia, with suppuration and necrosis, would, under favourable conditions, require not less than six months for recovery.

### Return to Work.

1. **Simple and Uncomplicated Fracture.**—The following conditions must be fulfilled before a patient is fit to return to work after a simple uncomplicated fracture:

(a) Union of the bone, firmly and in good position. Here a word of warning with regard to the X rays must be given. The X-ray picture is not altogether reliable as to the firmness of union of a fracture, because sometimes the uniting material appears abundant and firm when union is poor, and *vice versa*. The union, however, is frequently firmer than it appears to be.

It is also, taken alone, a very insufficient guide as to the utility of a limb, because sometimes a result will look very poor beneath the X rays while the usefulness of the bone is perfect; and, on the other hand, a perfectly straight, firmly united bone may be enclosed in a useless limb.

Again, the X rays are liable to exaggerate any deformity that may be present, because the picture produced is only a shadow, and, like all shadows, is liable to distortion. Moreover, any want of skill or carelessness in the operation of the X-ray apparatus may easily magnify a small error of position into an apparently very large error. As a rule, several pictures from different points of view are necessary in order to gain a correct idea of the position of the fragments in relation to one another. A stereoscopic photograph is now commonly taken.

(b) Approximately full range of movement of the adjacent joints and tendons.

(c) Approximately normal bulk and power of muscles necessarily wasted during healing of the fracture.

(d) Normal circulation in the parts concerned—*e.g.*, no swelling of leg on exertion.

It is clear, however, that the site of the fracture must be considered in relation to the nature of the occupation. Thus, after fracture of the patella, a bricklayer's labourer would be incapacitated from carrying loads up ladders for at least four months; whereas, after the same accident, a clerk would be able to follow his full occupation in a month.

Generally speaking, for limb fractures the above conditions are not fulfilled until a period of about three or four months beyond that required for union of the bone. (See above, Cure.) But in many cases some light employment could be followed several weeks before the patient is able to return to full and heavy work. In the case of skilled labour requiring fine movements and adjustments of limbs, the period of incapacitation might be prolonged considerably. Thus, after a Colles's fracture a navy would be fit for full work in three months, but a typewriter or pianist would be incapacitated for several weeks longer, on account of the fine movements required in the wrist and fingers.

Again, in some occupations deformity must be considered from the point of view of employment. Thus, a fracture of the malar bone may leave a deformity which would prevent a shop-assistant obtaining employment, but which would not affect a labourer at all.

2. **Compound Fracture.**—Other things being equal, a compound fracture which suppurates, but in which no other complications occur, will prevent a man from following his employment for a much longer period than a simple fracture.

3. **Complicated Fracture.**—Generally speaking, the fracture is recovered from before the attendant injury to some other structure, and therefore the period of incapacity for work will be determined by the latter rather than by the actual fracture. (See above, the various sections referred to under Consequences of Accident.)

4. **Ununited Fracture.**—Faults of union which require secondary operation will, as a rule, rather more than double the period of incapacity. This does not apply to immediate operations, such as wiring of the patella or olecranon, in which the operation actually shortens the period of incapacity.

5. **Injury other than Fracture: Acute Simple Inflammation of the Bone or its Sheath (Ostitis or Periostitis).**—This condition should not incapacitate a man from work for more than a week or a fortnight. If the symptoms persist beyond that time, the case comes under the next heading.

The disabling effects of a chronic simple ostitis may last for a considerable time, as persistent pain is apt to result from thickening of the bone (osteosclerosis). Moreover, the irritation set up by the presence of even a minute spicule of dead bone may cause symptoms that may last for months. It is very difficult to say how long such disability is likely

to continue. In osteosclerosis an X-ray examination gives some idea of the extent of the bone affection, but the degree of disablement must be decided upon other grounds, such as the nature of the patient's occupation and the probability or not of malingering. In the case of death of minute fragments of bone, operation will shorten the period of convalescence.

Further consequences of injury to bone other than fracture come under Diseases.

### Recurrence.

When a cure has been effected (see above, Cure), there is no risk of recurrence of an ordinary simple, uncomplicated fracture, except in the case of the kneecap. Refracture of this bone is not an uncommon occurrence, and its possibility must be borne in mind.

In very rare instances there may be recurrence of symptoms arising out of concomitant injury to other structures. Thus, after a Colles's fracture, extra strain weeks after return to work may produce inflammation of the tendon-sheaths which were damaged at the same time as the fracture, but this need not be anticipated.

After compound fractures where suppuration has occurred, several factors may enter into the possibility of recurrence of the consequences of the accident. There is always the remote possibility of recurrent abscesses forming in connection with minute fragments of dead bone. Then, in connection with the scars which in some situations, as over the tibia, remain adherent to the bone, slight injuries occasionally produce some ulceration ; but this, too, is uncommon.

**Complicated Fractures.**—The chances of recurrence of the effects of the accident in these cases are the same as those of similar accidents to the same structures apart from fracture. (See Brain, Nerves, Abdomen, etc.)

### Occupation Diseases.

Under this heading there is little to note, liability to fracture running concurrently with liability to severe accident of any kind. The forms of fracture peculiar to motor mechanics have been described above under Cure.

With regard to diseases of bones, the peculiar form of necrosis ("phossy jaw") formerly common amongst workers in phosphorus is well known. (See Poison—Phosphorus.)

## Diagnosis.

In the diagnosis of fracture and of other bony injuries or their results, the X-ray examination gives the greatest assistance; but it cannot be too strongly insisted upon that the correct interpretation of X-ray pictures may be a matter of the utmost difficulty. The foolish assumption that the picture "speaks for itself" may lead to gross injustice either to the employer or to the injured servant. It is not the X-ray picture itself, but the picture as interpreted by an expert, which is important. The following are some of the pitfalls:

(a) The appearance of the bones upon the plate, being only shadows, are liable to the same distortions as any other shadows.

(b) A bone may look perfectly straight from one point of view, but from another point of view some gross deformity may be revealed. [Plates III., IV.]

(c) Callus only shows when lime salts have been deposited in it; therefore absence of shadow around a fracture does not mean absence of callus, but absence of callus that has become sufficiently calcified to show.

(d) Callus throwing a dense shadow may be actually weaker than that which throws a much lighter shadow.

(e) Certain angles and other deformities in bones, after repair of a fracture, are not necessarily incompatible with perfect recovery of function, and, *per contra*, a bone which appears perfectly united may belong to a useless limb.

(f) Certain lines in bones upon the X-ray pictures, which may be taken for fractures by the uninitiated, are not fractures at all.

(g) Fractures without displacement may be revealed by the X rays, which would be undiagnosable by ordinary clinical methods—*e.g.*, certain fractures about the wrist from "back-firing" (chauffeur's wrist). [Fig. 32.]

(h) Occasionally all trace of a fracture, as discoverable by the X rays, disappears in a remarkably short space of time.

(i) Some of the consequences of injury to bones in the neighbourhood of joints, such as deposit of new bone in torn ligaments and periosteum, may not become visible upon an X-ray picture until months after the accident.

(j) The indications of such pre-existent conditions or diseases of bones, which might have led to fracture from a degree of violence too small to have produced that effect upon a normal

bone, may be no less equivocal. A tumour of bone which has been the predisposing cause of a "spontaneous" fracture may give no evidence of its existence in an X-ray picture, although it is quite obvious where its consistence is such as to be opaque to the rays. In the former case we rely upon clinical evidence for the diagnosis. For example, a woman trips over the edge of a carpet and sustains a fracture of the thigh. The X-ray examination is indecisive; on investigation a tumour, perhaps unnoticed before, is found in the breast, and shown to be cancerous. The case is one of spontaneous fracture due to secondary cancer of the bone.

Again, a man carrying a load experienced a sudden pain in his hip and fell to the ground. On examination he was found to have sustained a fracture in the upper part of the thigh. The X-ray examination showed extensive caries of the femur, which was eventually proved to be tuberculous.

When a bone has been rendered fragile from long disuse, or weakened by old disease long since recovered from (such as necrosis), the concomitant signs and history are usually sufficiently clear to allow of a correct diagnosis being made.

With regard to fracture of the base of the skull, the diagnosis is sometimes extremely difficult. Hæmorrhage from the nose or mouth may occur in head injury without fracture. Hæmorrhage from the ear (the prominent common symptom of fracture of the base of the skull) may be caused from rupture of the drum only. (See Ear, p. 247.) Fracture of the hinder part of the base of the skull (posterior fossa) may only be diagnosable by the appearance of bruising behind the ear several days after the accident. Again, paralysis of the face occurs sometimes from injury to the nerve in fracture of the base of the skull, but it also follows neuritis due to cold, as well as head injury without fracture. (See Ear, Facial Nerve, p. 249.)

### Malingering.

(a) Malingering as to having sustained a fracture is scarcely possible. In the most doubtful cases (*e.g.*, rib), the X-ray examination would decide the point. A man might claim to have fractured the base of the skull, adducing evidence of hæmorrhage from the ear, and feigning deafness and persistent headache, whereas in point of fact the injury has not caused any fracture. It is unlikely that an X-ray examination in this case would be of much assistance, but the malingering of deafness

could be detected by an Aurist. (See Ear.) And, moreover, this symptom arising from fracture is unlikely to occur without some paralysis of the face as well, inasmuch as the facial nerve runs for part of its course in the same bony canal as the nerve of hearing.

(b) Malingering of persistent incapacity. Persistent tenderness at the site of an injury to a bone—*e.g.*, a kick on the shin (tibia)—may be complained of. The malingerer can usually be detected by pressure upon the point of alleged tenderness whilst his attention is diverted. After injuries of the bones of the skull and spine, persistent headache may be asserted, or other nervous symptoms may be simulated. Neurasthenic malingering is not uncommon. (See Brain, p. 187, and Traumatic Neurasthenia, p. 588.)

After fracture of ribs, persistent pain, cough, and shortness of breath, may be complained of, although non-existent.

After fracture of the bones of the limbs, weakness, persistent pain, lameness, swelling of the limb on attempting to work, and imperfect range of movement of adjacent joints, may be complained of, notwithstanding that none of these symptoms are really present.

Swelling of a limb has been known to have been produced artificially by tying a tight cord round it high up the thigh. This cord was removed before the medical examination.

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*For legal cases of injury to Bone, see Medico-Legal Aspect of Accidents: Operations and CASE GUIDE, Bones.*

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## BOWEL.

See ABDOMEN, INTESTINES, PERITONEUM, RUPTURE.

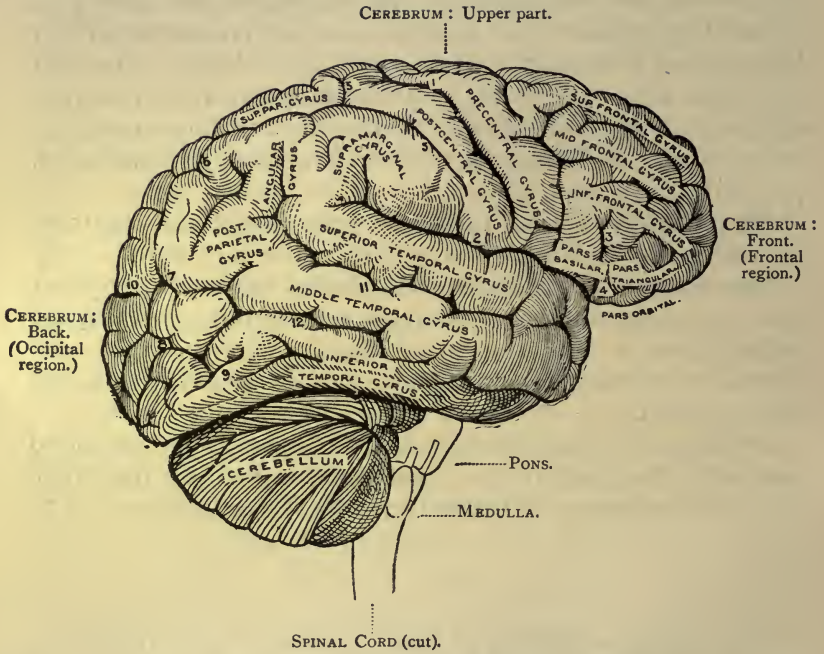


FIG. 39.—VIEW OF THE RIGHT SIDE OF THE HUMAN BRAIN, SHOWING THE VARIOUS PARTS: CEREBRUM (LARGE BRAIN), ABOVE AND IN FRONT; CEREBELLUM, BEHIND; PONS, IN FRONT AND BELOW; MEDULLA, BELOW AND BEHIND, ENDING IN THE SPINAL CORD, WHICH IS CUT.

(From Buchanan's "Anatomy.")



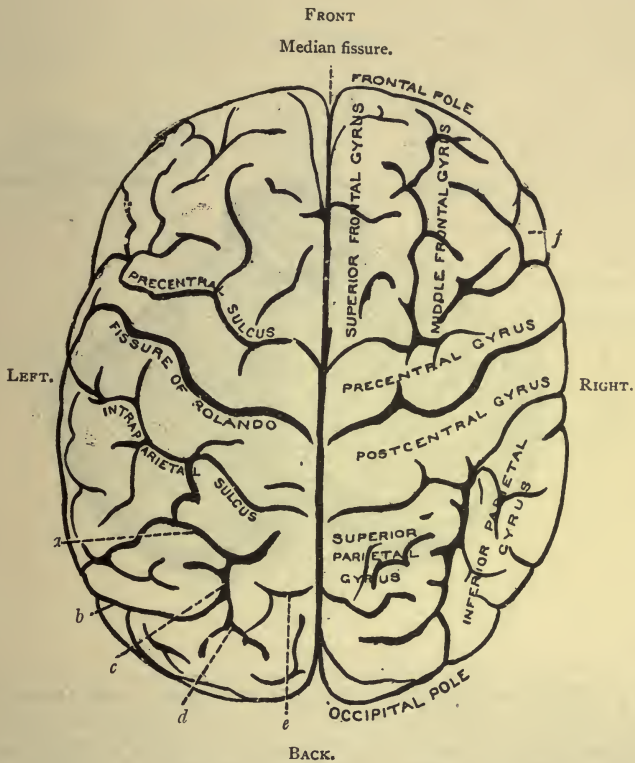


FIG. 40.—UPPER SURFACE OF THE LARGE BRAIN (CEREBRUM).

The median fissure divides the cerebrum into right and left halves, and is occupied by a partition of dura mater, the membrane covering the brain. This partition is called the "falciiform process," and along the upper border of it runs a great vein, the superior longitudinal sinus (Figs. 52, 53). The letters *a* to *f* indicate named areas.

(From Buchanan's "Anatomy.")

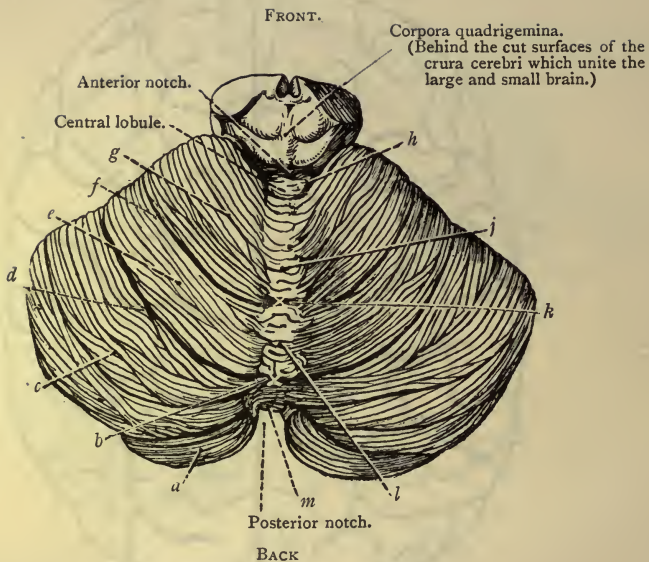


FIG. 41.—THE CEREBELLUM (OR SMALL BRAIN) SEEN FROM ABOVE, AND CUT AWAY, FROM THE LARGE BRAIN, IN FRONT OF THE CORPORA QUADRIGEMINA.

This upper surface is separated from the under surface of the back part of the large brain by a partition of dura mater, the tentorium cerebelli (Fig. 52). The letters *a* to *m* indicate named areas.

(From Buchanan's "Anatomy.")

CEREBRUM, or large brain—front (cut away).

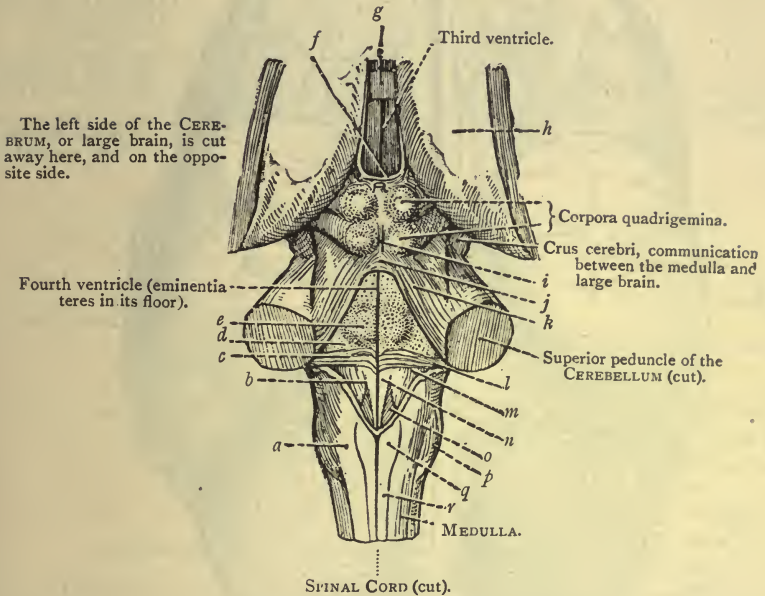


FIG. 42.—THE UPPER SURFACE OF THE MEDULLA, WHICH IS CUT OFF FROM THE SPINAL CORD BELOW. THE CEREBELLUM, WHICH NORMALLY COVERS IT IN THE MIDDLE, IS CUT AWAY, AND THE CEREBRUM (OR LARGE BRAIN) IN FRONT AND TO THE SIDES IS ALSO REMOVED. THE DIAMOND-SHAPED AREA THUS EXPOSED IS THE FOURTH VENTRICLE, IN THE FLOOR OF WHICH ARE SITUATED THE "VITAL CENTRES."

The ventricle is filled with cerebro-spinal fluid during life, and it communicates with the third and lateral ventricles above, and the central canal of the spinal cord below. (For ventricles, see Figs. 46, 47, 48.) The letters *a* to *r* indicate named areas.

(From Buchanan's "Anatomy.")

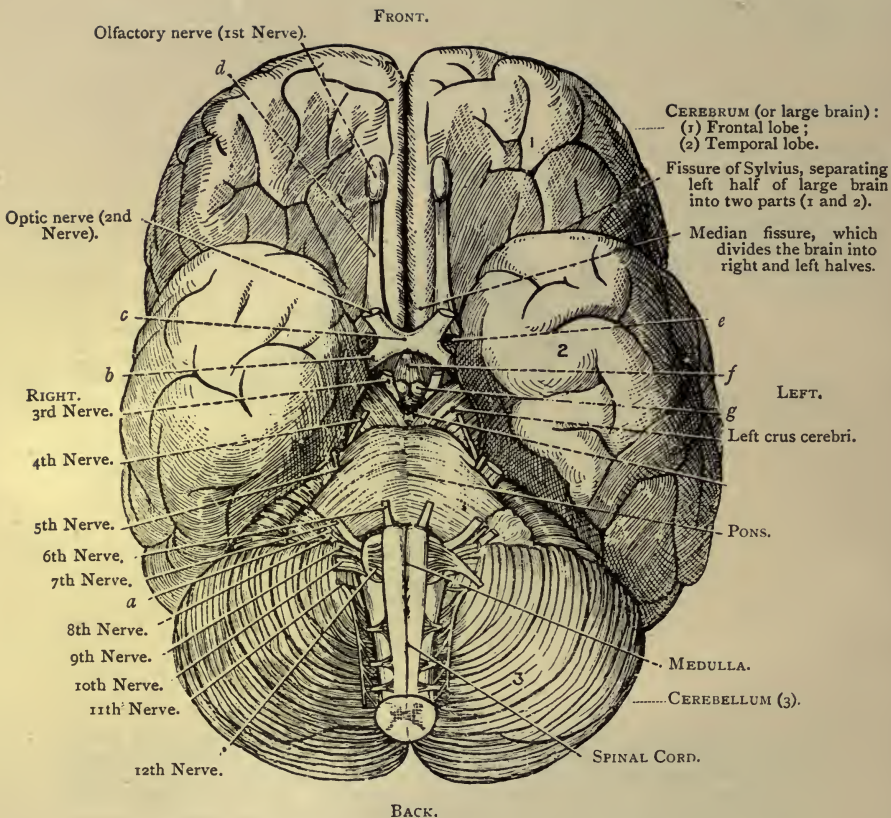


FIG. 43.—THE UNDER SURFACE OF THE BRAIN, FROM BOTH SIDES OF WHICH, NEAR THE MIDDLE LINE, PASS THE CRANIAL NERVES, TWELVE IN NUMBER, NUMBERED 1 TO 12.

1, Frontal lobe: front of the under surface of the cerebrum (large brain).  
 2, Temporal lobe: middle of the under surface of the cerebrum. 3, Cerebellum, covering the back part (the occipital lobe) of the under surface of the cerebrum. The letters refer to parts having special names.

(From Buchanan's "Anatomy.")

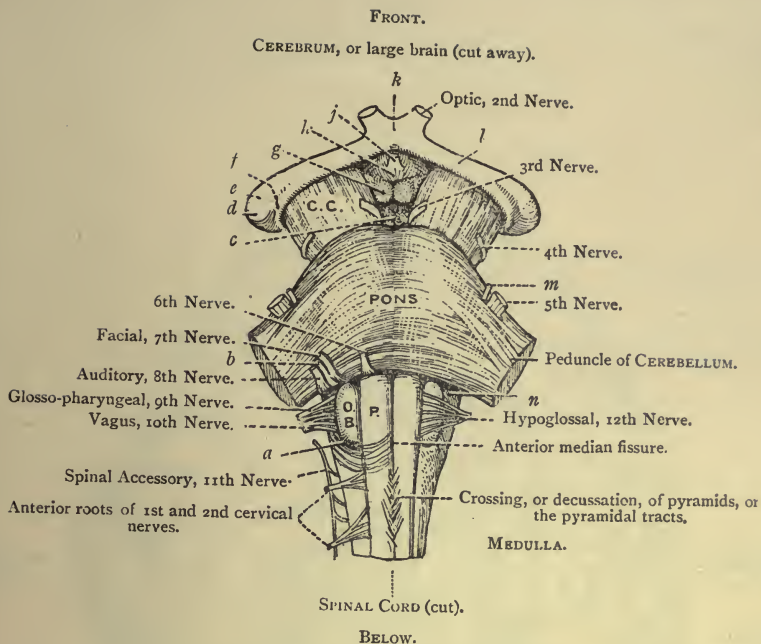


FIG 44.—UNDER SURFACE OF EACH CRUS CEREBRI (C.C.), THE PONS, AND MEDULLA, ON A LARGER SCALE THAN FIG. 43.

O, B, P, parts of the medulla. The letters *a* to *n* indicate named areas.

(From Buchanan's "Anatomy.")

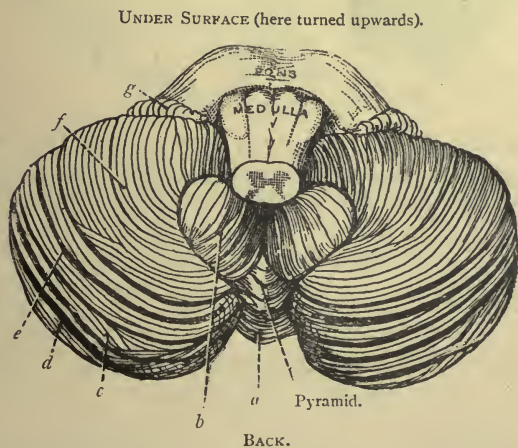


FIG. 45.—UNDER AND POSTERIOR SURFACE OF THE CEREBELLUM, MEDULLA, AND PONS.

The pons, cerebellum, and medulla, are removed and turned upside down. The letters *a* to *g* indicate named parts of the cerebellum.

(From Buchanan's "Anatomy.")

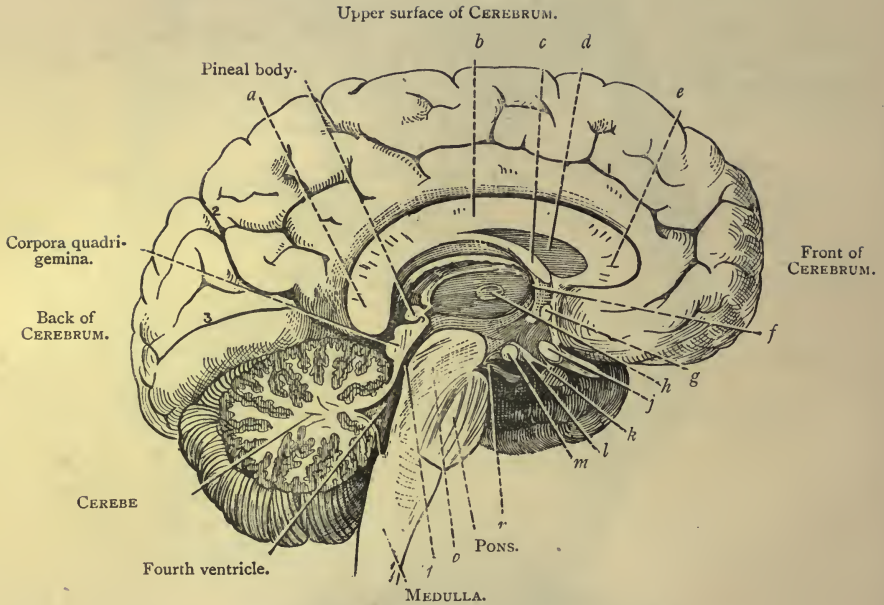


FIG. 46.—MIDDLE SURFACE OF THE LEFT HALF OF THE BRAIN.

The parts showing convolutions are not cut, and are covered during life by the process of dura mater (the falx cerebri) which divides the right and left halves of the brain (see Figs. 40, 52). The letters *a* to *p* indicate named areas.

(From Buchanan's "Anatomy.")

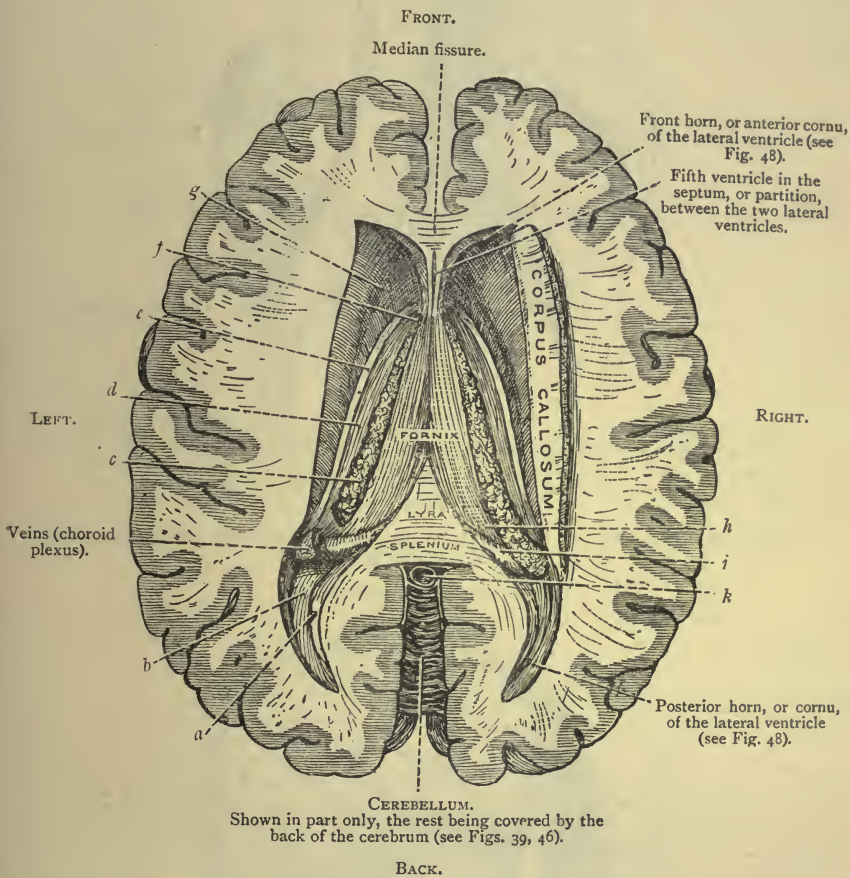


FIG. 47.—SECTION PRODUCED BY REMOVING THE UPPER PART OF THE CEREBRUM, OR LARGE BRAIN, AND EXPOSING THE VENTRICLES, WHICH ARE FILLED DURING LIFE WITH THE FLUID OF THE BRAIN AND SPINAL CORD (THE CEREBRO-SPINAL FLUID). THE SECTION ALSO SHOWS THE "GREY AND WHITE MATTER."

The letters *a* to *k* indicate named areas.

(From Buchanan's "Anatomy.")

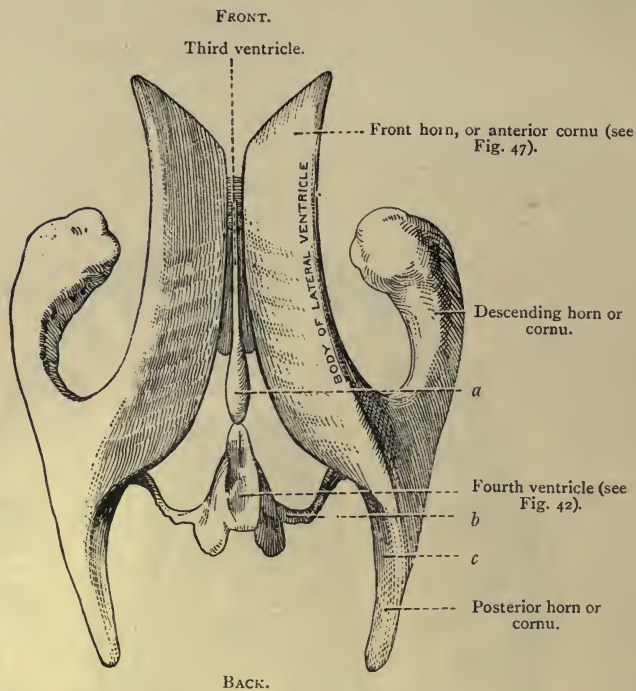


FIG. 48.—DRAWING OF METAL CAST, BY RETZIUS, OF THE FLUID SPACES, OR VENTRICLES, OF THE BRAIN.

(From Buchanan's "Anatomy.")

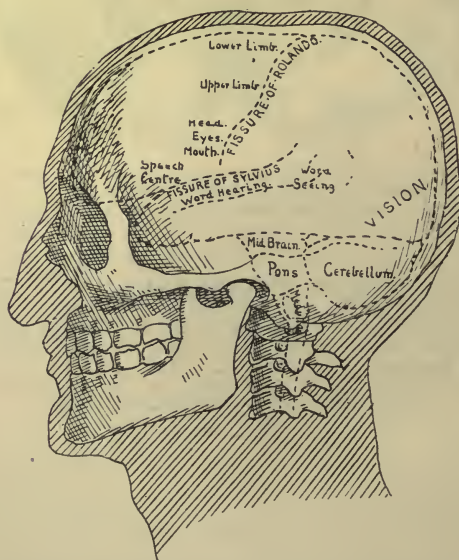


FIG. 49.—SCHEMATIC ILLUSTRATION OF THE SURFACE OF THE BRAIN, SHOWING THE "MOTOR AREAS," OR PARTS OF THE BRAIN WHICH "GOVERN" THE DIFFERENT PARTS OF THE BODY.



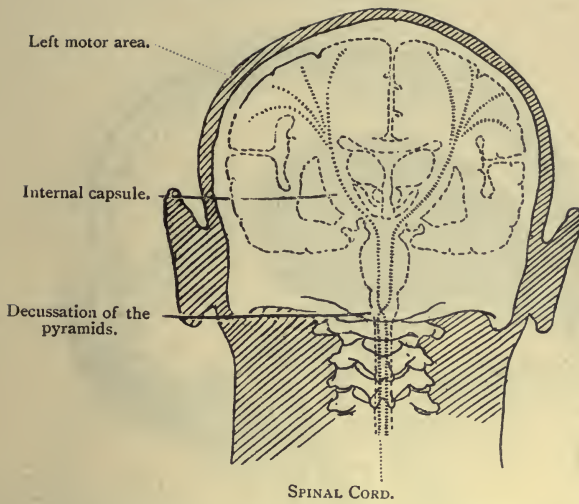


FIG. 50.—DIAGRAMMATIC SECTION THROUGH THE HEAD, TO SHOW THE COURSE OF THE MOTOR FIBRES FROM THE MOTOR AREA (SEE FIG. 49), THROUGH THE PYRAMIDAL TRACTS IN THE INTERNAL CAPSULE, DOWN TO THE MEDULLA, WHERE THEY CROSS OVER AT THE DECUSSATION OF THE PYRAMIDS (FIG. 44) TO REACH THE SPINAL CORD.

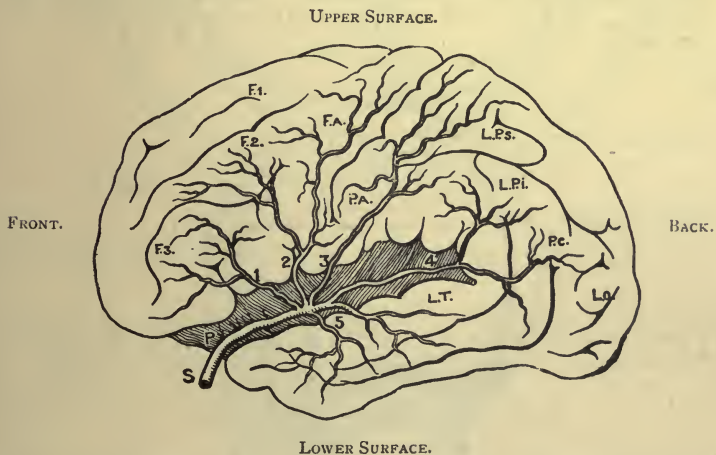


FIG. 51.—OUTER SURFACE OF THE LEFT HALF OF THE BRAIN, SHOWING THE FISSURE OF SYLVIIUS WIDELY OPENED, AND THE LEFT MIDDLE CEREBRAL ARTERY LYING IN IT.

S, Left middle cerebral artery; P, branches supplying the deeper parts of the brain. One of these arteries, the lenticulo-striate artery, is called the "artery of cerebral hæmorrhage," as it is particularly liable to be the source of cerebral hæmorrhage, or apoplexy.

(From Buchanan's "Anatomy.")

Falx cerebri : the partition of dura mater between the two halves of the large brain.

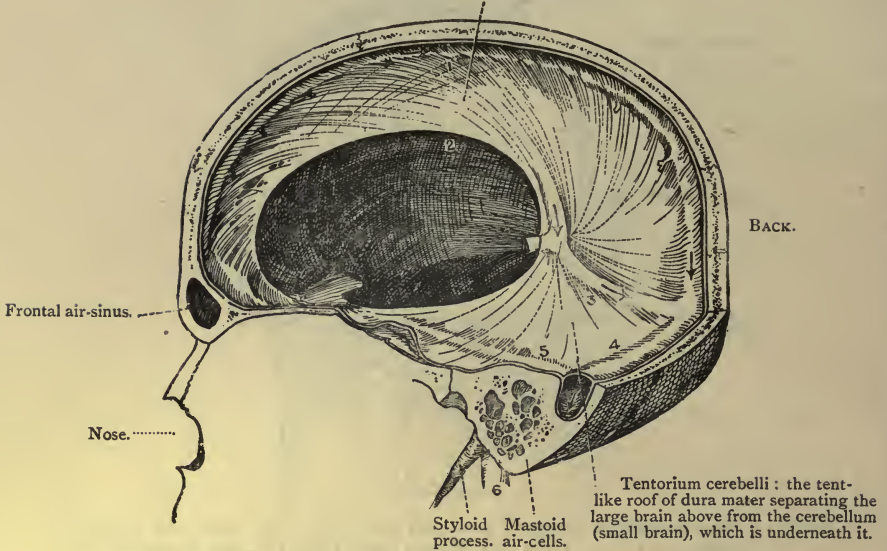


FIG. 52.—INTERIOR OF THE SKULL, WITH THE LINING MEMBRANE AND PARTITIONS OF DURA MATER ; BRAIN REMOVED.

The numbers 1 to 5 indicate the large canals (sinuses) for venous blood, which is eventually emptied into the internal jugular vein (6). The direction of the flow of blood is indicated by small arrows. 1, Superior longitudinal sinus (see Fig. 53); 4, lateral sinus (see Figs. 53, 54); 6, internal jugular vein (see Fig. 193).

(From Buchanan's "Anatomy.")

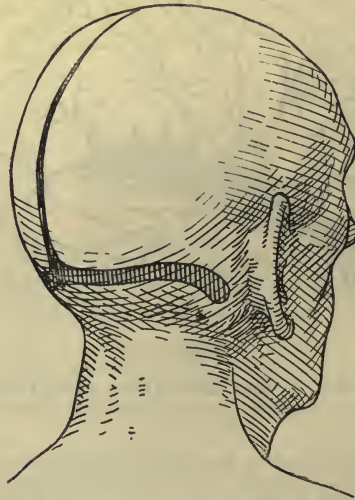


FIG. 53.—SCHEMATIC PROJECTION OF THE POSITION OF THE SUPERIOR LONGITUDINAL SINUS AND RIGHT LATERAL SINUS, SEEN THROUGH THE SKULL.

For the course of the internal jugular vein, see Fig. 193.

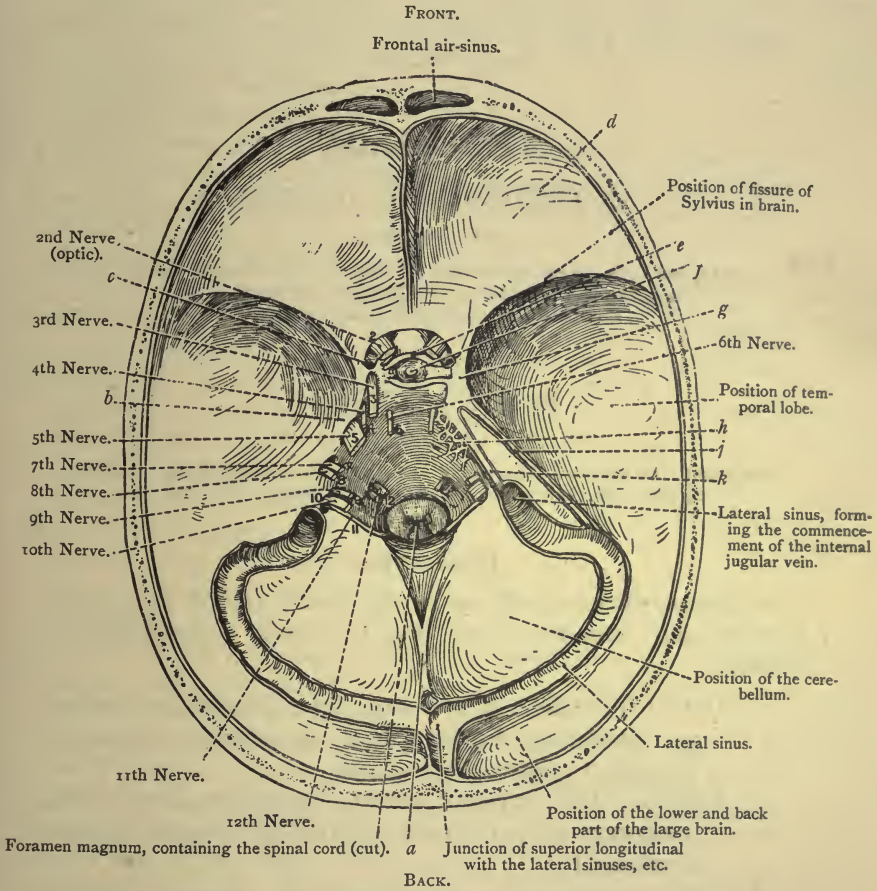


FIG. 54.—SKULL FROM WHICH THE UPPER HALF AND BRAIN HAVE BEEN REMOVED. THE CUT END OF THE SPINAL CORD AND THE NERVES ARE LEFT. THE RIGHT AND LEFT LATERAL SINUSES, ENDING IN THE COMMENCEMENT OF THE INTERNAL JUGULAR VEIN, ARE ALSO SEEN.

The letters *a* to *k* indicate named areas.

(From Buchanan's "Anatomy.")

# THE BRAIN.

BY FREDERICK E. BATTEN,

M.D., F.R.C.P.,

Physician to the Hospital for Sick Children, Great Ormond Street ;  
Physician to Out-Patients, the National Hospital for the  
Paralyzed and Epileptic, Queen Square ;

AND

PERCY SARGENT,

M.A., M.B., B.C. (CANTAB.), F.R.C.S.,

Surgeon to the National Hospital for the Paralyzed and Epileptic, Queen  
Square ; Surgeon to Out-Patients, St. Thomas's Hospital.

## Head-note.

THE consequences of injury to the brain are of very great diversity and complexity, but may be briefly summarized as follows :

*Death* : Immediate or at a later date, from the laceration or consequent disease either of extensive areas or important centres of the brain.

*Paralysis* : Of varying extent, immediate or remote temporary or permanent, partial or complete. (See Anatomy.)

*Fits* : Immediate or at a later date, caused by some injury or consequent disease which irritates the brain tissue.

*Neurasthenia* : See Neurasthenia, p. 455.

*Traumatic Insanity* : See Insanity, p. 530.

## Technical Terms.

*Abdominal Reflex*.—See Reflex.

*Accommodation Reflex*.—See Reflex.

*Æsthēsia*.—Literally “loss of feeling,” but technically loss of sensations, such as touch, temperature, and of the power of discrimination of objects by their feel. Caused by any interference

with the path of sensory impulses from the skin to the brain. Also present in some cases of "functional" disease. (See below.)

*Ānālgēsīa*.—Loss of the power of perceiving pain; e.g., an area of skin may be analgesic, but not anæsthetic, so that a sharp pin-prick would only be felt as *pressure*, and not as *pain*.

*Ankle-Clonus*.—See Reflex.

*Ankle-Jerk*.—See Reflex.

*Anterior Nerve Roots*.—The nerve as it leaves the spinal cord starts in two roots—one from the front (the anterior nerve root), the other behind (the posterior nerve root); the two unite to form the spinal nerve. (See below, Anatomy.) [Fig. 167.]

*Āphāsīa*.—Loss of the power of speech. *Motor* aphasia means inability to give expression to ideas in words: an object, although correctly recognized, cannot be named. There is no interference with the muscles of speech. *Sensory* aphasia means inability to appreciate the meaning of written or spoken words.

*Ārāchnoid*.—One of the membranes covering the brain.

*Argyll-Robertson Pupil*.—See Reflex.

*Ātāxia*.—See Inco-ordination.

*Atlas*.—The first (cervical) vertebra of the neck, on which the base of the skull rests.

*Auditory Nerve*.—Nerve of hearing. [Figs. 43, 44, 54.]

*Axis*.—The second (cervical) vertebra of the neck, which articulates with the atlas.

*Brachial Plexus*.—The great bundle of nerves (in the neck) which supply the arm. [Fig. 140.]

*Capsule*.—See Internal Capsule.

*Cārōtid Artery*.—A large vessel supplying blood to the brain.

*Cauda Equīna*.—The end of the spinal cord is prolonged into a bundle of nerves, which, from the likeness to a horse's tail, is called the "cauda equina." [Fig. 140.]

*Cērēbellum*.—Small brain. [Figs. 39, 41, 43, 45.]

*Cērēbrō-spinal Fluid*.—The fluid medium which surrounds the brain and spinal cord.

*Cērēbrum*.—Large brain. [Figs. 39, 40.]

*Cōma*.—A condition of profound unconsciousness.

*Compound Fracture*.—A fracture in which the broken surfaces of the bone are in direct communication with the exterior through a wound in the skin or the lining membrane of the mouth.

*Contrecoup*.—Damage may be caused to a part of the brain, but not the skull, by injury to the opposite side of the head. This is called "contrecoup." (See below, Consequences of Accident.)

*Corneal Reflex*.—See Reflex.

*Cortex*.—The surface of the brain, consisting of grey matter, is thrown into numerous folds called "convolutions." The grooves

or depressions between the convolutions are called "sulci" or "fissures." [Figs. 39, 40, 47.]

*Convolutions.*—See Cortex. [Figs. 39, 40.]

*Crūs.*—A part of the brain between the large brain and the pons and medulla. (See below.) [Figs. 42, 43, 44, 46.]

*Dūrā Mater.*—A tough membrane covering the brain, in close contact with the skull. [Fig. 52.]

*Epilepsy.*—A disease producing fits of unconsciousness, with or without convulsions. It occurs in two forms (major and minor), which may be present in the same individual.

*Epilepsy Major* is the form of epilepsy characterized by convulsive fits and loss of consciousness.

*Epilepsy Minor* is the form characterized by loss of consciousness without convulsions.

*Foramen Magnum.*—The large hole at the base of the skull through which passes the spinal cord.

*Eye Reflexes.*—See below, Reflex.

*Functional Disease.*—Disease in which the symptoms are not due to any recognizable changes in the tissue of the organs.

*Glossy Skin.*—The smooth, shiny appearance presented by the skin after injury to the nerves which supply it.

*Gyrus.*—A synonym for "convolution" (*q.v.*).

*Hēmianæsthēsia.*—Loss of sensation on one side of the body.

*Hēmianōpia.*—Loss of vision to one side of the body.

*Hēmiplēgia.*—Loss of power on one side of the body.

*Hemisphère (Cerebral).*—Half of the large brain (cerebrum).

*Inco-ordination.*—Such loss of control over the muscles as to cause inability to perform ordinary movements in an orderly manner. This condition is sometimes known as "ataxia." It is not necessarily accompanied by any affection of the mind or intelligence.

*Internal Capsule.*—A band of fibres in the deeper parts of the brain, carrying impulses from the surface of the brain to the spinal cord and cranial nerves. [Fig. 50.]

*Knee-Jerk.*—See Reflex.

*Light Reflex.*—See Reflex.

*Mēdulla Ōblōngāta.*—The expanded upper end of the spinal cord which forms the commencement of the brain. [Figs. 39, 42, 43, 44, 45, 46, 49.]

*Mēningitis.*—Inflammation of the brain membranes, the meninges.

*Middle Mēningēal Artery.*—The largest artery which supplies the covering membranes (*dura mater*).

*Motor Cortex.*—The name given to that part of the surface of the brain the stimulation of which gives rise to movements of the opposite side of the body. [Figs. 49, 50.]

*Motor Nerves.*—The nerves which convey impulses from the brain

and spinal cord to the muscles whereby contractions of the muscles are brought about; hence the name "motor nerves."

*Muscular Atrophy*.—Wasting of muscles.

*Neuritis*.—A term indicating inflammation in a nerve; often inaccurately used to indicate pain in the course of a nerve.

*Optic Nerve*.—Nerve of sight (2nd nerve). [Figs. 43, 44, 54, 70, 71, 74.]

*Optic Neuritis*.—Inflammation of the optic nerve in the eye. (See Eye.)

*Organic Disease*.—Disease in which the symptoms are caused by some recognizable changes in the tissues or organs. Used in contradistinction to functional disease.

*Paraplēgia*.—Loss of power in the legs.

*Peripheral Neuritis*.—A term used to describe a particular form of disease due to inflammation of the nerves.

*Piä Mater*.—A thin membrane covering the brain, in close contact with the brain itself.

*Plantar Reflex*.—See Reflex.

*Pons*.—Portion of brain connecting the large brain with the medulla and spinal cord. [Figs. 39, 43, 45, 46, 49.]

*Posterior Nerve Root*.—See above, Anterior Nerve Root. [Fig. 167.]

*Posterior Root Ganglion*.—A small swelling situated on the posterior root of the spinal cord. It contains a number of nerve cells, connected with the sensory functions. [Fig. 167.]

*Pyramidal Tracts*.—The two great strands of motor nerve fibres, connecting the brain and spinal cord. [Figs. 44, 50.]

*Reflex*.—A reflex action is a movement (muscular response) produced by a sensory stimulus, which is usually that of touching or striking some part of the body. There are certain well-known reflex actions which, by their presence or absence, are indicative of disease of the nervous system. The following is a list of the best known :

*Abdominal Reflex*.—When the skin of the abdomen is gently stroked, a contraction of the abdominal muscles occurs, giving rise to a movement of the navel in an upward or downward direction, according to the position of the stroke.

*Accommodation Reflex*.—When a person, after looking at a distant object, looks at a near object, the pupil contracts.

*Ankle-Clonus*.—An abnormal condition present under circumstances in which, when the sole of the foot is pressed upward, an alternating up-and-down movement of the foot results.

*Argyll-Robertson Pupil*.—See Eye Reflexes.

*Corneal Reflex*.—When the surface of the eye is touched, a closure of the eyelids takes place.

*Eye Reflex (Argyll-Robertson Pupil)*.—When the pupil of the eye will contract on looking at a near object, and fails to act to

light, an "Argyll-Robertson pupil" is said to be present. This is always indicative of grave cerebral or spinal disease.

*Light Reflex.*—The contraction and dilatation of the pupil produced by light and darkness.

*Plantar Reflex.*—When, in normal individuals, the sole of the foot is gently stroked, the big toe is bent downwards.

In certain diseases this reflex is reversed, and the toe turns upward when the foot is stroked (extensor type of the plantar reflex).

*The Ankle-Jerk.*—When the tendon above the heel is struck, a contraction of the calf muscles takes place, and the foot is jerked down.

*The Knee-Jerk.*—When the tendon below the knee-cap is sharply struck, a contraction of the muscles takes place, and the leg is jerked forward.

(The absence or exaggeration of these reflexes is suggestive of disturbance of the nervous system.)

*Sensory Nerves.*—The nerves which convey sensations, such as pain, heat, cold, etc., from the skin, etc., to the posterior nerve roots, whence they pass up to the brain, and produce the feelings of pain, etc. The sensory nerves also control the health of the skin, injury to them producing "trophic changes," such as "trophic ulcer," "glossy skin," etc.

*Shock.*—A condition of profound depression of the central nervous system, due to some severe injury.

*Spastic Päräplēgia.*—Paralysis of the legs associated with rigidity.

*Thēca.*—The sheath of dense fibrous tissue (spinal dura mater) within which the spinal cord is suspended inside the vertebral canal.

*Trophic.*—When certain nerves are injured, changes take place in the tissues which those nerves supply; *i.e.*, the integrity of the skin depends upon the integrity of its nerves. Such changes are called "trophic."

### Anatomy and Physiology (or Function).

The following are the subjects considered under this head:

- (a) Anatomy.
- (b) Physiology, or Function.
- (c) Coverings.
- (d) Bloodvessels.
- (e) Nerves from the brain.

(a) **Anatomy.**—The brain comprises the two cerebral hemispheres, or large brain; the cerebellum, or small brain; the pons, or bridge uniting the different parts of the brain; and the medulla, or expanded upper end of the spinal cord. [Figs. 39, 43.]



The cerebral hemispheres constitute by far the largest part of the brain, and lie in close contact with the skull above a line drawn from the top of the bridge of the nose along the eyebrow to the outer corner of the eye, thence to the orifice of the ear, and backwards to the most prominent point of the back of the head, the occipital protuberance. Behind the ear and below that line lies the cerebellum, also in contact with the skull.

Each cerebral hemisphere is connected with its fellow of the opposite side, with the cerebellum, and with the expanded upper end of the spinal cord, the medulla. [Figs. 39, 40.]

The cerebellum consists of two large lateral halves, the cerebellar hemispheres, and a smaller middle portion, the middle lobe. The cerebellum is connected with the cerebral hemispheres, with the pons, and with the spinal cord. [Figs. 39, 41, 43, 45.]

*The Pons.*—A broad band or bridge chiefly composed of fibres running between the cerebrum and the medulla to the spinal cord, or between one side of the cerebellum and the other. It also contains embedded in it some nuclei. (See below.) [Figs. 39, 43, 45, 46, 49.]

The medulla, or expanded upper end of the spinal cord, is in shape an elongated pyramid, with the broader end upwards to the pons, and having a transverse diameter of about an inch; and the lower end pointing downwards and backwards, where it merges into the spinal cord, of a transverse diameter of about  $\frac{1}{2}$  inch. Its upper surface is flattened out into a shallow space known as the "fourth ventricle," which lies hidden under the cerebellum. [Figs. 42, 46, 49.] Its lower end passes through the large hole at the back of the skull, known as the "foramen magnum." [Figs. 49, 54.] In the mid-brain, the pons, and medulla, are situated those groups of grey matter called "nuclei," from which impulses start along the nerves of the head, for movements of the eye muscles, tongue muscles, etc. These groups of cells are called "motor nuclei," and are connected by nerve fibres with the motor area of the brain.

In the medulla are also placed the "vital centres"—namely, those groups of nerve cells which control the heart, the circulation, and the breathing, injury to which causes immediate death.

*Ventricles.*—The brain is a hollow organ containing a branching cavity which continues right through the pons and medulla down to the end of the spinal cord. The various parts of this cavity in the brain are called "ventricles." Two large lateral ventricles occupy the two sides of the cerebrum, or large brain;

a smaller one occupies the upper surface of the medulla, which is called the "fourth ventricle." [Figs. 42, 46, 47, 48, 49.]

The surface of the brain is indirectly connected by nerve fibres with the muscles and every other part of the body. On the surface of the brain, lying just in front of the deep fissure called the "fissure of Rolando," is an area known as the "motor area," and the course of the nerve fibres from this to the spinal cord is as follows: From the nerve cells in the cortex fibres pass deeply, and are collected into a comparatively small band called the "internal capsule"; they then pass through the "crura cerebri," or mid-brain and the pons and the medulla. Here they cross into the opposite side of the spinal cord, and form the great motor or "pyramidal" tracts of the spinal cord, finally becoming connected with the motor cells of the cord, from which fibres are continued to the muscles of the body. [Figs. 40, 44, 49, 50.]

The brain consists of grey and white matter. The grey matter is darker in colour, has more bloodvessels, and contains both nerve cells and nerve fibres: it is the originating part of the brain. The white matter is the conducting part, and consists of nerve fibres running between and connecting the various masses of grey matter in the brain and spinal cord. [Fig. 47.]

The grey matter is mainly disposed upon the surface of the brain (cortex), which, in order to increase its surface area, is thrown into numerous folds known as "convolutions." Important masses of grey matter are also found embedded deeply in the base of the brain, and in the substance of the pons and medulla.

(b) **Physiology and Functions of the Brain.**—Certain portions of the hemispheres are known to have definite functions: the front portion probably deals with mental processes; the middle portion with the movements of the face, limbs, and trunk; and the hinder portion with vision. There is a centre in the left hemisphere which controls the expression of ideas in words (commonly known as the "speech centre"). [Fig. 49.]

Paralysis is produced by destruction of any part of the motor tract. (See Anatomy.)

Irritation of the motor area, as by fragments of broken bone, may cause fits commencing in the opposite of the body, while destruction causes paralysis on the opposite side of the body.

The manner in which the nerves conveying sensation travel from the skin to the brain is much more complicated, but the

effect is the same—namely, that the sensation of one half of the body is represented in the opposite half of the brain.

The hinder part of the great brain is concerned with vision. [Fig. 49, 74.]

The cerebellum controls the muscular movements of the body so as to cause them to act in an orderly manner; disease of this part leads to upsetting of this orderly action (inco-ordination).

(c) **Coverings of the Brain.**—*Dura Mater.*—The whole brain within the skull is enclosed within a dense, strong envelope of fibrous tissue known as the “dura mater,” from which partitions pass inwards between the two halves of the great brain, and between the great brain and the cerebellum, called the “falx cerebri” and “tentorium cerebelli.” [Fig. 52.]

*Arachnoid.*—Within the envelope of dura mater is a very delicate covering, the arachnoid.

*Pia Mater.*—Within this, again, and forming a very close investment for the brain, is the pia mater, which carries the bloodvessels, and which in places is prolonged into the interior of the brain. Between the arachnoid and pia mater is a space, known as the “subarachnoid space,” which contains clear fluid, known as “subarachnoid fluid,” which is part of the cerebro-spinal fluid.

(d) **Bloodvessels of the Brain.**—The blood is conveyed to the brain by means of four large arteries—the two internal carotid arteries, passing from the neck through the base of the skull, and the two vertebral arteries, which reach the interior of the skull by way of the large opening (foramen magnum) through which the spinal cord emerges. [Fig. 54.]

From these vessels many large branches penetrate into the interior of the brain, whilst others run in the pia mater upon its surface. [Fig. 51.]

One large branch in particular is known as the “artery of cerebral hæmorrhage,” because it is one which often becomes ruptured in apoplexy. It lies close to the band of fibres from the motor area called the “internal capsule.” [Fig. 51.]

From the brain the blood is returned by veins, some of which lie deeply, whilst others lie upon the surface, and pass into the great blood-channels (sinuses) which run close to the bone in the outer covering of the dura mater. [Figs. 52, 53, 54.] These are liable to be torn in injuries to the head. In the dura mater also run certain arteries, known as “meningeal arteries,” which supply blood to the coverings of the brain. One in particular,

the middle meningeal artery, is of large size, and is particularly liable to be torn in fracture of the skull, giving rise to symptoms of pressure upon the brain. It runs on the inner surface of the skull just in front of the ear.

(e) **Nerves from the Brain, and their Functions.**—From the surface of the brain emerge the twelve pairs of head or cranial nerves, which pass between the motor nuclei and the muscles and skin of the head and organs of the special senses.

These nerves are spoken of by numbers, and are as follows :

I. The *First* (Olfactory) is the nerve of smell, conducting sensations from the nose to the brain. It lies just above the roof of the nose, which is here a very thin plate of bone, perforated by numerous apertures, through which the branches of the olfactory nerve pass into the nose. [Figs. 43, 147.]

II. The *Second* is the Optic Nerve, or nerve of sight, and conducts visual sensations from the eye to the brain. [Figs. 43, 44, 54, 70, 71, 74.]

III., IV., VI. The *Third*, *Fourth*, and *Sixth* nerves convey impulses from the brain to the muscles which move the eye. The *Third* also causes the pupil to contract. [Figs. 43, 44, 54.]

V. The *Fifth* (Trigeminal) is the great nerve which conducts sensations from the skin of the face and scalp, and the membrane lining the mouth, tongue, and palate. It also supplies the impulses of movement of the muscles of the jaws which are concerned in eating. [Figs. 43, 44, 54.]

VII. The *Seventh* (Facial) is the nerve conveying impulses of movement to the muscles of the face. It runs through the ear, where it is often damaged by disease of the ear, and occasionally by fracture of the base of the skull. [Figs. 43, 44, 54.]

VIII. The *Eighth* (Auditory) is the special nerve of hearing, but it is also concerned in maintenance of equilibrium. [Figs. 43, 44, 54.]

IX. The *Ninth* is a nerve conveying sensations from the back of the tongue and throat. [Figs. 43, 44, 54.]

X. The *Tenth* (the Vagus) is a very important nerve connected with the heart, lungs, and stomach. [Figs. 43, 44, 54.]

XI. The *Eleventh* (the Spinal Accessory) conveys impulses to certain muscles of the neck. Some of its nerve fibres pass with the vagus to the muscles of the larynx, and those concerned in swallowing. [Figs. 43, 44, 54.]

XII. The *Twelfth* (Hypoglossal) is the motor nerve to the muscles of the tongue. [Figs. 43, 44, 54.]

### Consequences of Accident.

The consequences and importance of injury to the brain depend on three things :

- The extent of the injury done, which is not necessarily proportionate to the severity of the accident.
- The nature of the injury.
- The locality.

The injury to the brain may be the result of a fall, a blow, a gunshot, a stab, or an electric shock.

The injury may give rise to no definite symptoms indicating the locality of the lesion, or that locality may be clearly indicated by the symptoms which appear.

The immediate result may be loss of consciousness, convulsions, giddiness, faintness, and vomiting. Paralysis of the face and eye muscles and of the limbs may be present, and there may be loss of sight, hearing, speech, and feeling in the skin.

Though the bone of the skull protects the brain from severe injuries to some extent, yet, on the other hand, injuries which in other situations might be trivial, when they occur in the region of the central nervous system, give rise to severe and widespread symptoms—*e.g.*, hæmorrhage within the skull as compared with hæmorrhage beneath the skin.

Hæmorrhage is a common consequence of accident to the brain, and is discussed below, under Compression.

**Contrecoup.**—It used to be taught that a blow upon the head could cause a fracture of the part directly opposite in the line of the force applied. It is very doubtful whether this actually happens. This *fracture of the skull by contrecoup* must, however, be carefully distinguished from *injury to the brain by contrecoup*, which undoubtedly does happen. Thus, a blow upon one ear may result in bruising of the brain in the neighbourhood of the opposite ear (temporal lobe).

Fracture of the skull owes almost its only importance to the possible concomitant injury to the brain. (See Bones.)

Any of the following conditions may occur either with or without fracture of the skull :

- (i.) Concussion.
- (ii.) Compression.
- (iii.) Laceration.
- (iv.) Epilepsy.

(v.) Meningitis, abscess, tumours, and cysts.

(See below, Disease.)

(vi.) Neurasthenia.

(vii.) Traumatic insanity.

(i.) **Concussion.**—By this is meant the condition produced by an injury to the head which is characterized by sudden loss of consciousness of varying duration, but unaccompanied by symptoms of gross injury to the brain, such as fits or paralysis.

(ii.) **Compression.**—The brain is enclosed in, and almost completely fills, a rigid walled cavity; any addition to the contents of this cavity must cause pressure upon the brain. Such pressure may be local or general, and may be caused in consequence of an injury by bone driven inwards (depressed fracture of the skull), by bullets, by blood from a torn vessel, or by spread of inflammation from the site of the injury (meningitis, cerebral abscess, etc.). If the case is a severe one, unconsciousness is rapidly produced, gradually deepens, and ends in coma and death unless relieved by operation. In a less severe case the symptoms may be more localized, and may produce paralysis of one side of the body without complete loss of consciousness.

(iii.) **Laceration (Tearing of the Brain Substance).**—This heading embraces a class of case midway between the last two. Symptoms of concussion are present at first, but there is in addition some tearing of the brain substance with hæmorrhage; but this is insufficient in amount to cause severe symptoms of pressure upon the whole brain. When consciousness returns—*i. e.*, when the concussion has been recovered from—there remains a well-recognized condition known as “cerebral irritation”; and if the laceration has occurred in an area with known functions, there will in addition be symptoms pointing either to irritation or destruction of that area. Thus, in the motor area there will be either fits or paralysis of the muscles corresponding to the parts injured.

(iv.) **Epilepsy.**—Epilepsy may occur in three forms after injury to the head: (a) Grand-mal (major epilepsy); (b) petit-mal (minor epilepsy); (c) traumatic (Jacksonian epilepsy).

(a) *Epileptic Fits* may occur at any time after the accident, whether the brain be injured in the motor or other area.

(b) *Petit-mal*, or fits of minor epilepsy, may also occur under similar conditions.

(c) *Traumatic Jacksonian Epilepsy.*—When a portion of the skull has been driven inwards, so as to press upon the brain,

or when blood effused beneath the skull remains as a collection of fluid, or when a scar results from tearing of the brain or its membranes, there may be set up the condition known as "traumatic epilepsy." In this the patient is subject to periodic fits of a peculiar nature, which always begin with definite movements in the muscles governed by that part of the brain which is the seat of irritation, and which gradually, but rapidly, spreads in a definite manner to other muscles.

(v.) **Meningitis, Abscess, etc.**—See below, Disease.

(vi.) **Neurasthenia.**—(See Neurasthesia, p. 580.)

(vii.) **Traumatic Insanity.**—(See Insanity, p. 455.)

**Locality injured.**—The parts of the brain which are at all commonly injured, and the chief symptoms to which such injuries give rise, are as follows:

**CEREBRUM.**—*Superficial.*—Frontal: The injury, if in the frontal region, may give rise to no symptoms, or may cause mental symptoms, deviation of the eyes to the right or left, or loss of smell. [Figs. 39, 40, 43, 49.]

**Motor Area:** The injury, if in the motor regions of the brain, will be followed by paralysis or twitchings of the opposite side of the body, either immediately or soon after the accident. [Figs. 39, 40, 49, 50.]

**Speech:** If the injury be on the left side of the brain (in a right-handed man), the speech centre may be affected, and the patient, though he may perfectly understand what is said to him, is yet quite unable to express his ideas in words. [Fig. 49.]

**Posterior Part:** If, on the other hand, the brain be injured in the posterior part, hemianopia may be present—*i.e.*, the patient is blind to objects on one side of the body, and there may be loss of sensation on the same side. [Figs. 39, 40, 49.]

*Deep.*—**Internal Capsule:** Paralysis of the opposite side will also follow if the accident injure the fibres from these areas anywhere between the surface of the brain and in the place in the medulla where the fibres cross over to the other side. [Fig. 50.]

As the fibres coming from the area of the brain which controls movement (motor cortex) become the more closely packed in their course the farther they go from the surface, so a greater degree of paralysis will result from a hæmorrhage into the internal capsule, where they are all collected in a small area of about  $\frac{1}{2}$  inch in diameter, than from a similar sized hæmorrhage on the surface (cortex) of the brain. (See below, Vessels of the Brain.) [Figs. 50, 51.]

**PONS.**—The pons is rarely injured, and those cases in which it is must be rapidly fatal. [Figs. 39, 43, 45, 46, 49.]

**MEDULLA.**—Any injury to the medulla is immediately or rapidly fatal. [Figs. 39, 42, 43, 44, 45, 46, 49.]

**CEREBELLUM.**—The cerebellum is but rarely injured. [Figs. 39, 41, 43, 45.] It is possible to conceive that bleeding might occur into the substance of the cerebellum as the result of injury, and give rise to symptoms of ataxia on the same side; that is, the man would lose control over his muscles, and would be unable to perform movements in an orderly manner. In addition he might have “forced movements,” or would find that, when he attempted to do anything, his muscles would go too far and overdo the movement he was attempting. In neither case would there be any interference with the rest of the brain as regards intelligence, etc.

Bleeding on the surface of the cerebellum might also occur, but would probably give rise to no localizing symptoms by which the situation of the bleeding could be discovered.

**Subsequent Effects.**—The subsequent effects of these accidents will depend on the amount of damage done. The power of recovery after damage and laceration of the brain substance is considerable.

There may be permanent paralysis, which, however, may be, and generally is, considerably less than the paralysis which occurred at first. When the brain is only pressed on, not actually torn or injured, the blood causing the pressure will be absorbed in time, and the relief of pressure will be accompanied by relief of symptoms.

If the compressing agent is not blood, but a depressed fracture or spicule of bone from the inner surface, then no relief is to be expected without operation.

The mental symptoms may be loss of memory, headache, delusions, irritability, and loss of nervous control. It may be followed by incapacity for sustained mental or physical work. It may be followed by giddiness, inability to go into high places, and dread of closed places. (See *Insanity*, p. 455.)

### Disease.

**1. Caused by the Accident.**—Inflammation of the coverings of the brain (meningitis), and abscess of the brain, or even epilepsy, may follow an injury to the brain.

It is far more common for an injury to be followed only by functional disturbance of the nervous system than by actual



disease. It is possible that in these cases some diseased condition may underlie the nerve disorder, although no such change can be shown to exist. The rapidity with which, under suitable circumstances, such patients recover would seem to make it probable that there is no destruction or alteration of tissue. The terms "traumatic neurasthenia," and "traumatic neurosis," and "fright neurosis" are those which are used to describe such conditions. It is only to be expected that individuals with unstable nervous systems are more liable to suffer from such disturbances than those with greater stability.

Inflammation anywhere about the head may spread to the brain and infect the brain coverings, causing meningitis or abscess of the brain. Such causes are a septic wound, allowing the actual introduction of dirt and microbes at the time of the accident, as in compound fracture, bullet wounds, stabs, etc., or the microbes may be carried to the injured brain from some distant parts by means of the blood-stream. Infection introduced by any of these means results commonly in the production of meningitis, or inflammation of the coverings of the brain; less commonly an abscess of the brain results. Both conditions are exceedingly dangerous to life. They do not necessarily follow close upon the injury in point of time, but may be delayed for many months. These symptoms will depend in part upon their locality, for which see above.

The relation of tumour formation and tuberculous and syphilitic inflammation to injury is too indefinite and uncertain to be of any medico-legal value whatever. The formation of blood-cysts, and the appearance of areas of softening of the brain due to blocking of veins (thrombosis) after injury, and the conditions which give rise to Jacksonian epilepsy, have been described above. They are not, strictly speaking, disease, but the direct consequences or complications of the injury.

Possibly in some cases injuries are the starting-point of certain well-recognized organic diseases of the central nervous system, such as disseminated sclerosis or paralysis agitans.

**2. Existing before the Accident and aggravating its Effects.**—Certain local and general diseases already present, and certain constitutional tendencies, may exercise a considerable influence upon the course of a case of injury to the brain, Such are—

(a) Local disease of the bones of the nose, ear, or skull. This may, with or without any fracture of the skull, be responsible for the spread of inflammation to the brain and

its coverings. This is especially so in the common condition of old ear disease, and the consequence may be meningitis or abscess of the brain. (See above, Disease.)

(b) Disease of the bloodvessels of the brain, whether syphilitic or otherwise, will tend to accentuate the effects of an injury.

(c) The presence of chronic alcoholism, syphilis, tuberculosis, or kidney disease, may alter what would in a healthy person be a trivial injury into one of a serious nature.

(d) Nervous disease. The effects of an injury on a person who is already the subject of a nervous disease would in most cases accentuate the symptoms and prolong the period of recovery.

### Operation.

Operation may be necessary after injury to the brain for—

- (a) Removal of fragments of bone driven into the brain, or bullets and other foreign bodies lodged within the skull.
- (b) Raising a depressed fracture, or for removing a splinter of the inner table after injury to the skull. (See Bones—Skull [Fig. 24].)
- (c) Arrest of bleeding from torn vessels in the membranes of the brain.
- (d) Relief of pressure within the skull, whether from escape of blood into or around the brain or from extension of inflammation.
- (e) Opening of an abscess of the brain.
- (f) Certain forms of epilepsy.

In none of these cases is the risk of the operation itself very great. What danger there is in any given case lies in the extent of damage already present when the operation is undertaken, and which can rarely be gauged with any certainty before operation. Recovery is to be expected in cases of depressed fracture when no serious damage has been done to the underlying brain, and in cases of escape of blood between the bone and dura mater without other serious injury. When the bleeding has been beneath the dura mater or into the substance of the brain, the outlook is less good. The risk of operation for traumatic epilepsy is slight, though the prospect of cure may be small. The risk of operation for draining an abscess of the brain is not in itself grave, though the prospect of recovery is very remote.

### Cure and Return to Work.

In no class of injury is it more difficult to lay down general rules under this heading than in injuries of the brain. So much depends upon the nature and extent of the injury, upon the occupation of the patient, and upon the previous stability of his nervous system, which varies so enormously in different individuals.

Thus, after a moderately severe concussion of the brain, complete cure in a labourer may be expected in a few weeks; but the same injury in a man engaged in mental work may incapacitate him for many months, from loss of memory, loss of power of mental concentration, headache, irritability of temperament, and so on. Again, attacks of giddiness may cause little or no inconvenience in the case of a plumber who has so far recovered as to perform his ordinary plumbing work, but they would incapacitate him from work which involved ascending ladders.

In the more severe classes of brain injury, it is doubtful if a patient ever regains completely his former capacity for work, and the degree to which cure will proceed in any given case will depend upon the nature and extent of the injury, the condition of the patient at the time of the accident, and the nature of his occupation.

Every case has to be judged upon its own individual merits after brain injuries to a greater extent than after any other accident.

### Recurrence.

Early return to work after apparent cure is likely to be followed by recurrence of symptoms, or to the development of a new train of symptoms (neurasthenia.) This is, of course, especially true in those who are engaged in business entailing responsibility. The liability to suffer from headache and sleeplessness lasts for a long while, and may readily be aggravated by return to work.

In addition to these psychological symptoms there may occur, after return to work, symptoms dependent upon some definite local pathological state. Thus, fits which were due at first to the irritation of effused blood, and which ceased during convalescence, may after return to work recur, being due to some definite and permanent damage to the brain. The recurrence of such fits means permanent disablement.

### Diagnosis.

The value in diagnosis of such signs as headache and vomiting is small in comparison with other signs, such as optic neuritis, paralysis, or convulsions, which can be observed, and, if genuine, are quite out of the control of the patient. Any of these may, however, be absent in undoubted cases of injury to the brain.

The three cardinal symptoms of gross intracranial disease are *headache*, *vomiting*, and *optic neuritis*. When present together, they are clear evidence of the presence within the skull of something, such as a tumour, abscess, or some other gross disease which causes an increase of the pressure. In other words, they are evidence of an increase of intracranial pressure or tension.

Headache is entirely a subjective symptom, and therefore less reliance can be placed upon it than upon vomiting and optic neuritis, which are definite objective symptoms. Vomiting due to disease of the brain is periodic, unconnected with food, and unaccompanied by nausea.

As regards injuries to the head, pain, as just stated, being a subjective symptom, is of less value than the other two, especially when unaccompanied by them.

Vomiting is an extremely common symptom of head injury. It occurs during recovery from concussion, and may persist for days, especially if the concussion is accompanied by laceration; it is often present in cases of hæmorrhage causing compression; and it may possibly occur when, for any reason (hæmorrhage, inflammation, etc.), an increase takes place in the size of a cyst that has resulted from an injury.

Optic neuritis is a sign of the greatest value. It does not occur in the majority of head injuries, but when present after such an injury it is evidence of increased pressure within the skull either from hæmorrhage or inflammation. Its presence in a person who has sustained an injury to the head is not conclusive as having been caused by the injury, because it may have been previously present from pre-existent disease; e.g., a person with an early cerebral tumour may sustain an injury to the head even in consequence of a fall due to the tumour. In such a case the appearance of the optic nerve, together with other symptoms which would be elicited on examination, would enable a correct diagnosis to be made.

The diagnosis of disease of the nervous system depends on the presence of well-marked signs.

If the motor surface of the brain be injured, paralysis (hemiplegia) of the opposite side of the body results.

The distribution of the paralysis depends on the seat of the injury. If the injury be near the top of the skull, the legs will be more paralyzed than the arms; if lower down, the arms and the face will be more paralyzed than the legs. In paralysis from an injury to the brain the paralyzed limbs are usually stiff. The knee-jerk, the arm-jerk, and the ankle-jerk are increased on the paralyzed side. Ankle-clonus is present, and the plantar reflex is extensor in type. The abdominal reflex is absent. (See Technical Terms—Reflex.)

If the injury is on the left side of the brain, speech may be affected. The patient may be able to say "Yes" or "No" correctly in answer to questions, but cannot express ideas in words or name objects, and yet may know what is the use of the article shown.

If the injury be in the hinder part of the brain, the man will be blind to the opposite side of the body (hemianopia). If the injury is at the base of the skull, the nerves of smell may be damaged. The optic nerve may be damaged, causing blindness in the corresponding eye. The nerves for the movements of the eyes may be affected. (See Nerves of the Brain, p. 176.)

If the injury be farther back, the nerve of hearing may be damaged; and as this nerve in part of its course is very close to the nerve of the face, facial paralysis may also be present.

Damage to the fore part of the brain gives rise to no paralysis, but it may cause major or minor epilepsy.

In conclusion, it may be said that the diagnosis of diseases of the nervous system depends on the presence of well-marked signs. The distribution of the paralysis, the condition of the eye muscles and nerves, the presence of optic neuritis, the condition of the muscles, the distribution of loss of sensation, the condition of the reflexes, and the electrical reaction of muscles, are the leading points for investigation.

The differentiation of organic disease of the nervous system from functional disease or malingering is usually easily made by the presence of definite physical signs.

In the case of an injury superimposed on an old disease it is often difficult to assert that the condition may not have been due to the injury—*e.g.*, one leg may be somewhat thinner than the other. Such a condition may have dated from childhood, and have escaped notice until attention had been called to the defect by medical examination.

The diagnosis of functional disease from malingering is often a matter of considerable difficulty. Both patients tend to exaggerate their symptoms; in neither is there any sign of organic disease.

The malingerer may feign a symptom of organic disease, but this he can so rarely feign with accuracy that detection is not difficult. It is far more common for him to complain of excessive pain and general weakness, and though he may appear in good health, it is impossible to assert that the symptoms of which he complains are not present. The slightest injury may, in a patient who is susceptible to suggestion, give rise to extensive symptoms. If these suggestions are encouraged by relatives and friends, the symptoms become so fixed in his mind that the patient is truly convinced of the reality of his complaint.

#### Occupation Disease.

Workers in certain metals are liable to suffer from various forms of paralysis: lead, mercury, and arsenic are the most common metallic poisons.

*Lead* commonly causes paralysis of the muscles of the back of the wrist, so that the patient has "wrist-drop." [Fig. 154.] The poison may, however, affect the shoulder muscles, and also the muscles of the leg, so that the patient has difficulty in walking. (See Poisons—Lead.)

*Mercury* causes a tremor of the muscles, so that the person is in constant movement. (See Poisons—Mercury.)

*Arsenic* gives rise to symptoms very similar to lead, but affects the legs more frequently than the hands, and gives rise to more pain and tenderness of the limbs. It also causes considerable darkening (pigmentation) of the skin, together with intestinal symptoms. (See Poisons—Arsenic.)

Writers, telegraphists, typists, treadlers, musicians, hat-makers, and others in whom there is an oft-repeated movement, are liable to a loss of control over the muscles involved in the movement.

The condition is most common in law-writers, and the so-called "writer's cramp" may be taken as a type of this form of disease. The symptoms develop gradually, and are usually attended with pain in the arm. When the person attempts to write, the fingers fail to grasp the pen and to work in coordination so as to form the letters. It is only for this particular movement that the fingers fail to act, for the person can

perform all movements with the fingers perfectly well. After a period of rest, many persons are able to resume their work, but are extremely likely to have a recurrence of the condition, and eventually have to change or give up their work, or in one-handed work learn to use the other hand.\*

### Malingering.

The malingerer may attempt to simulate some well-known result of an injury to the brain—paralysis of one side (hemiplegia) or epilepsy.

In the case of hemiplegia, absence of all signs of disease and the character of the paralysis (for it needs a most accurate knowledge of disease to simulate it) would leave but little doubt as to whether the condition was assumed.

A malingerer can never feign true epilepsy. He may feign a fit, in which he may fall, become rigid, and struggle violently; but he can never follow the whole sequence of phenomena which occur in an epileptic fit, and the corneal reflex is never abolished. (See Reflexes.) A malingerer may use a drug (atropine) to produce dilatation of the pupil of the eye. The common claim that an accident has produced "shock to the nervous system" is always difficult to disprove. The general health of the patient may be perfectly good, and physical examination may reveal no evidence of disease.

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*For legal cases of injuries to the Brain, see CASE GUIDE: Brain.*

\* Telegraphist's cramp is included in the third schedule of the Workmen's Compensation Act, 1906



FIG. 55.—A CANCEROUS BREAST IN LONGITUDINAL SECTION, SHOWING THE WAY IN WHICH THIS DISEASE IN ITS COMMON FORM CAUSES THE BREAST TO SHRINK AND RETRACT THE NIPPLE.

The dotted outline shows the position of the same breast before it became diseased.



# THE BREAST.

By JOHN BLAND-SUTTON,

F.R.C.S. (ENG.),

Surgeon to the Middlesex Hospital; Senior Surgeon to the Chelsea Hospital for Women; Formerly Hunterian Professor, Royal College of Surgeons, etc.

## Head-note.

The important consequences of injury to the breast may be—  
Bleeding into the tissues of the breast.

The formation of an abscess.

The occurrence of a malignant tumour, which may be a cancer or a sarcoma.

## Technical Terms.

*Ācĭnus*.—A space in the breast lined with epithelial cells which secrete milk.

*Adĕnōma*.—An encapsuled innocent tumour in the breast, composed of epithelium and connective tissue.

*Ārĕōla*.—The thin pigmented skin surrounding the base of the nipple.

*Cĭst*.—An encapsuled collection of fluid or milk in the breast. Such cysts are sometimes due to the dilatation of a milk duct.

*Cancer (Cărcĭnōma)*.—A malignant tumour arising in epithelium. (See Sarcoma.)

*Ēpĭthĕlium*.—"A covering." This is a superficial layer of cells lining the alimentary canal from the lips to the anus, as well as the ducts and glands connected with it, such as the salivary organs, the liver, and the pancreas. It also lines the respiratory organs from the tip of the nose to the ultimate recesses of the lungs; the genital passages and the glandular bodies connected with them—for example, the womb, testicles, etc. The urinary organs are lined with epithelium from the minute tubules in the kidney to the end of the urethra. Epithelium also covers the surface of the skin, and lines the sweat and grease glands lodged in it.

*Fibro-ādēnōma*.—An adenoma in which fibrous tissue very largely predominates over the epithelial elements.

*Gūmma*.—A tumour-like mass which forms in the body in the late stages of syphilis.

*Hæmātōma*.—A collection of blood extravasated into the tissues.

*Lōbūle*.—Part of a secreting gland which has a definite duct to convey the secretion.

*Lymphatics*.—See Lymphatic.

*Mamma*.—The mammary gland or breast.

*Māstītīs*.—A chronic disease of the true or secreting elements of the breast, characterized by irregular thickening of these tissues.

*Mēdiāstīnum*.—The space which lies in the middle line of the thorax or chest; it has the lungs on each side, the breast bone in front, and the spinal column behind. It contains the heart, great vessels, the windpipe, the gullet, and numerous lymph glands.

*Sārcōma*.—A malignant tumour arising in connective tissue. (See Carcinoma.)

*Trāumātism*.—A wound or injury caused by physical forces external to the body. Also violence producing a wound or injury.

### Consequences of Accident.

(a) Bruises.

(b) Wounds.

(c) Carcinoma, etc. (See Disease.)

(a) **Bruises**.—The breast, like other superficial parts of the body, is liable to injury in the form of blows, knocks, and stabs, and it may be bruised by the individual falling on her breast or knocking it against hard bodies like bedposts and the corners of furniture. It is sometimes injured by hard bodies, such as a brick, a stone, or a book. A common form of accident is a blow on the breast from an elbow in a struggle or in a crowd; brutal men inflict serious injuries on this part of women by blows with the fists and even kicks. Street accidents constitute another common class of injury, such as being run over by vehicles or kicked by horses. Nursemaids often complain of being thumped on the breast by unruly children, and those engaged in hard work receive accidental blows from broom-handles and other forms of hand implements, or from machinery. Pressure from hard corsets has often been blamed for injuring the breasts.

In the out-patient room of a general hospital a large number of women are treated annually for bruises of the breast. When the breast is injured, like other parts of the body the damaged

tissues bleed, and as the mammary tissues are soft, the blood sometimes infiltrates them freely, producing the usual purple staining of the skin, familiarly known as a bruise. Many slight injuries of the breast, although they cause great pain (for the tenderness of the breast is proverbial), are not accompanied by any staining of the skin, although there may be an effusion of blood (an hæmatoma) in the deeper tissues. As a rule, an effusion of blood (or hæmatoma) rarely causes more than temporary inconvenience. The effused blood quickly absorbs, and in a few weeks there is nothing to indicate that the breast has been injured. (Abscess, see below, Disease.)

When much blood has been discharged into the tissues of the breast, there remains for many months a hardened lump with indefinite outlines. This lump is supposed in some patients to be the starting-point of cancer of the breast.

For abscess, see below, Disease.

(*b*) **Wounds.**—Stabs or cuts occurring in the breast have no special features, except perhaps bleeding. When the injury is inflicted by a dirty instrument, the wound may become septic and suppurate.

### Disease.

1. **Caused by the Accident.**—(*a*) Abscess; (*b*) cancer (carcinoma); (*c*) sarcoma; (*d*) tumours, simple or non-malignant.

(*a*) **Abscess.**—An abscess is very common in the breast of a nursing woman. It is due to microbes making the entry through some small wound, usually a crack on the nipple. It hardly ever is caused by an accident. In some cases, especially where the skin has been broken, septic micro-organisms obtain access to the effused blood and cause pus to form. This leads to the formation of an abscess, which may retard recovery for a few weeks. As a rule, injuries and bruises of the breast heal quickly.

(*b*) **Cancer (Carcinoma).**—This is a common disease of the breast; indeed, the breast shares with the stomach and the uterus the distinction of being the most frequent situation in which cancer occurs primarily.

Out of every hundred cases of malignant disease of the breast, ninety are carcinomata and the remainder some form of sarcoma.

All surgeons who have devoted close attention to cancer of the breast agree that many patients attribute the cause of the disease to some injury. It may be assumed that blows and

similar severe mechanical insults to such a delicate organ as the breast cause so much pain and leave such an impression on the mind of the sufferer that it is rarely forgotten. A definite proportion of women with cancerous breasts, which amounts to at least 10 per cent., will state unasked that they have received an injury to the breast. In some the blow occurred a few months previously, in others as much as thirty years before.

There can be little doubt that the majority of women have received at some period of their lives a knock upon the breasts, and that the frequency with which women attribute the cause of a cancerous tumour within the breast to an injury is largely due to the belief, deeply rooted in their minds, that such injuries are the common cause of cancer; and though 10 per cent. of patients with this disease in their breast can and do assign a specific injury as the starting-point, it is probably true that not one per thousand of women who have received a severe blow on the breast becomes the victim of cancer.

(c) **Sarcoma.**—This is an unusual tumour of the breast, and it has already been mentioned that sarcomata form about 10 per cent. of the malignant tumours of this organ.

In regard to sarcoma of the breast, there is a definite opinion held by experienced surgeons to the effect that there are many carefully observed and thoroughly reported cases in which primary sarcoma of the breast has quickly supervened on a single intensive injury. The sarcomatous nature of such tumours has been ascertained by a microscopic examination at the hands of a competent pathologist, and their malignant nature has been confirmed by the early death of the individual. It is undeniable that a single intensive blow or knock on the breast may be occasionally followed by a sarcomatous tumour.

Surgeons see very many patients with sarcomata who cannot recall any preceding injury to the part, and of the enormous number of contusions and injuries, even intensive injuries, only an infinitesimal proportion is followed by sarcomata. Small as is this number, the circumstances relating to the sequences are such as to lead surgeons to believe that a single "intensive" injury may occasionally induce the growth of a sarcomatous tumour, and to place it outside the category of mere coincidence.

(d) **Tumours, Simple or Non-Malignant.**—A new growth of a non-malignant nature is not produced in the breast by accident.

2. **Existing before the Injury and aggravating its Effects.**—**Cancer (Carcinoma).**—When cancer of the breast is

associated with preceding injury, it neither aggravates the disease nor increases the risk of operation.

**Tumours.**—The chief simple tumour-diseases of the female breast are adenoma, chronic mastitis, and gumma. Of these, adenoma and the indurated lumps and cysts associated with chronic mastitis are not caused by injury, but they are frequently mistaken for cancer.

**Gumma.**—All individuals affected with syphilis are liable to develop a syphilitic tumour, or gumma, which may appear at the seat of an injury. In the case of the breast, a gumma is very likely to be mistaken for a cancerous or a sarcomatous lump.

### Operation.

(a) **Bruises.**—No operation is required in the case of simple bruises.

(b) **Wounds.**—An incision may require stitching, but otherwise there is no operation necessary.

(c) **Abscess.**—The abscess must be opened, and the incision should follow the line of the lactiferous ducts, which radiate from the nipple towards the circumference of the breast. In this way the risk of cutting them across is made as small as possible.

(d) **Carcinoma or Sarcoma.**—The removal of a cancerous breast entails very little risk. In the hands of an experienced surgeon the mortality of removing a diseased breast is less than 1 per cent.

### Cure.

(a) **Bruises.**—Usually about a week or ten days is sufficient for the cure of a bruise.

(b) **Wounds.**—If a wound has been stitched up it should be quite well in fourteen days.

(c) **Abscess.**—Abscesses are often slow in healing, especially in women who are broken down in health. No exact period can be given for the cure.

(d) **Carcinoma or Sarcoma.**—The wound is usually soundly healed in fourteen days if the patient's general health is good and she be free from any constitutional affection, such as chronic renal disease or diabetes.

### Return to Work.

(a) and (b) **Bruises and Wounds.**—Bruises and wounds will not prevent a person from returning to work at the end of surgical cure.

(c) **Abscess.**—A short period of convalescence, of about a week or ten days, may be required after the cure of an abscess of the breast.

(d) **Carcinoma or Sarcoma.**—Three weeks is the usual period of convalescence, which should be spent in the country or at the seaside. At the end of this period the patient should be able to work again.

### Recurrence.

There is no risk of recurrence from the consequences of bruises and wounds. An abscess that appears to be cured will sometimes give trouble at a later date.

Cancer and sarcoma always tend to recur, but where these diseases follow an injury the chances of recurrence are as uncertain as in ordinary cases of cancer of the breast. The liability of recurrence is greater in sarcomatous than in cancerous patients, and, as a rule, it returns earlier.

### Occupation Diseases.

**A Wet-Nurse.**—A syphilitic child, especially if its mouth be ulcerated, is very liable to infect the nipple or the breast of a wet-nurse. The most common kind of chancre is a shallow, circular, and painful ulcer situated near the base of the nipple. In some cases the primary lesion may be a crack or fissure. Sometimes the initial ulcer is very large.

### Diagnosis.

It must be remembered that many lumps in the breast, supposed to be cancerous when merely examined by the eye and fingers, prove to be non-malignant when examined microscopically. Although surgeons have been looking at tumours of the breast since the days of Hippocrates, and even before that, yet to-day there is no unequivocal sign by which cancer may be recognized. In the early stages of this disease a hard, irregular, indefinitely circumscribed lump is felt in the breast, which is, as a rule, painless. In many instances the wisest and most experienced surgeons cannot be certain whether the lump is cancerous, or due to chronic inflammation of the true mammary tissue (mastitis), a tumour of the glandular tissue (a fibro-adenoma), or a dilatation of one of the ducts (a cyst), or a specific infection, such as is found in syphilis or tubercle, and sometimes an abscess.

Age is of some assistance in the diagnosis of uncertain lumps

in the breast. No undoubted case of mammary cancer has been recorded in a patient before the fifteenth year. There are very few examples recorded before the twenty-fifth year. The greatest number are met with in women between the twenty-fifth and the fiftieth years. It may occur at any age after fifty, and has been observed in women ninety years of age.

Although absolute ignorance prevails concerning the cause of cancer, experience teaches us that this disease is more prone to attack organs and tissues which are the seat of chronic disease than those which are healthy.

The attitude of surgeons as reflected in their writings concerning the influence of trauma, or physical insults, as an ætiological factor in the production of malignant tumours in the breast, justifies the following statement: In regard to cancer, (carcinoma) all surgeons of experience admit that there is a definite history of intensive mechanical injury in about 10 per cent. of the patients. They are very careful not to express a definite opinion as to the casual relationship of such injuries to the formation of cancer in the breast. There is also a paucity of published statements from surgeons of great experience affirming traumatism as a cause of mammary cancer.

*Sarcoma* occurs at an earlier age than cancer, and women, unmarried or married, are most liable to this form of malignant disease between the twentieth and fortieth years of life, whereas cancer is more frequent between the thirty-fifth and fiftieth years. Women often attribute this disease to injury, especially to what may be called an "intensive injury."

### Malingering.

Women often complain of pain in the breast after injury without any detectable lump being present. No dangerous disease exists in the breast without obvious physical signs.

### Criminal and Self-inflicted Injuries.

The left breast is occasionally injured by women who attempt to commit suicide by stabbing or shooting themselves in the heart. Rarely women in a fit of religious mania attempt to mortify their bodies by mutilating their breasts with knives and similar implements.

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## BURNS.

See HEAT.



FIG. 56.—BEAT KNEE OR HOUSE-MAID'S KNEE.

The clear space in front of the kneecap is a natural cavity filled with fluid, but distended.

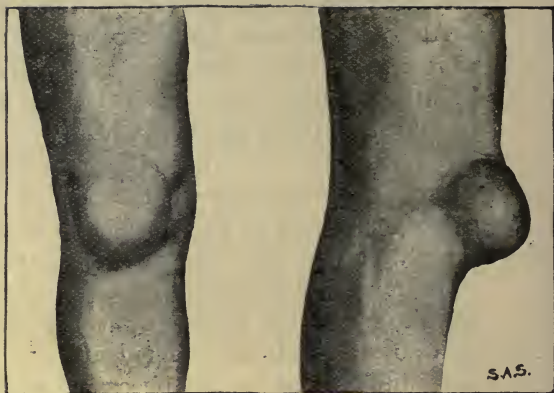


FIG. 55.—FRONT AND SIDE VIEWS OF THE KNEE, SHOWING THE SWELLED BURSA OF BEAT KNEE OR HOUSE-MAID'S KNEE.

(From Rose and Carless's "Surgery.")

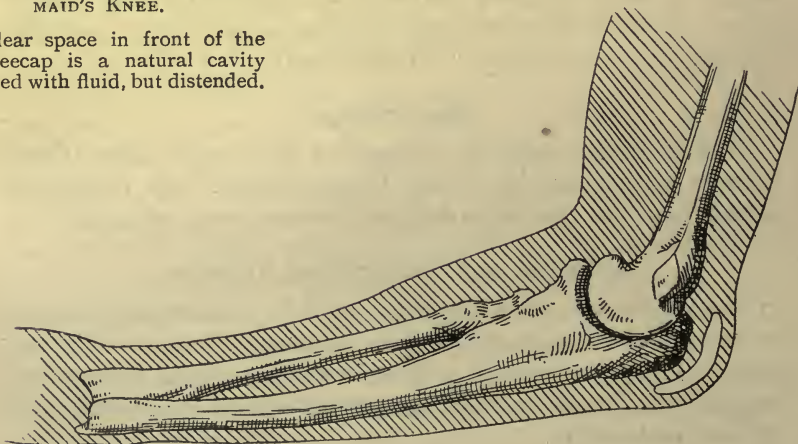


FIG. 57.—MINER'S BEAT ELBOW.

The clear space at the tip of the elbow is a natural cavity filled with fluid, but distended.



# THE BURSÆ.\*

BY A. H. TUBBY,

M.S. (LOND.), F.R.C.S. (ENG.),

Surgeon to the Westminster Hospital and to the Royal National Orthopædic Hospital for the Deformed; Consulting Surgeon to the Evelina Hospital for Children;

AND

E. ROCK CARLING,

B.S. (LOND.), F.R.C.S. (ENG.),

Assistant-Surgeon to the Westminster Hospital; Senior Assistant-Surgeon to the Seamen's Hospital, Greenwich.

## Head-note.

IN consequence of injury bursæ may become inflamed and form matter.

## Technical Terms.

*Bursæ*.—A water-cushion placed over the sharp bony prominences of the body to lessen friction and protect them from injury. They are of two kinds—true and false. True bursæ are present naturally in many parts of the body, well known to the anatomist. False bursæ arise as the outcome of long-continued but intermittent pressure. Bursæ may communicate with a joint or with the sheath of a tendon. Both forms of bursa contain a glairy fluid, usually thin, sometimes of the thickness of unboiled white of egg. It is secreted by the lining of the bursa, which is smooth and shiny, like the interior of a joint.

*Bursitis*.—Inflammation of a bursa.

*Synovial Fluid*.—The fluid which, in small quantities, is normally present in joints, tendon-sheaths, and bursæ. It acts as a lubricant for the surfaces of the joints, and enables the tendons to run smoothly in their sheaths. It is secreted by the lining membrane of the joints, etc., and when this is inflamed may be much increased in amount.

## Anatomy.

For the anatomy of bursæ, see above, Technical Terms.

\* Beat elbow and beat knee are included in the third schedule of the Workmen's Compensation Act, 1906.

### Consequences of Accidents.

Bursæ may be injured in consequence of—

- (i.) Contusions.
- (ii.) Wounds.
- (iii.) Continued irritation.

(i.) **Contusions.**—Blows or falls upon bursæ may result in pouring out of blood into the cavity. This blood may be absorbed, may form a mass of fibrous tissue, or may form matter. Or, on the other hand, such injuries may produce inflammation of the lining membrane, resulting in a gradual or rapid distension of the cavity with an excess of the fluid they usually contain, or with matter.

(ii.) **Wounds.**—Wounds may produce precisely similar effects, but the formation of matter is more likely to occur than in the case of simple bruising.

(iii.) **Continued Irritation.**—Continued irritation often leads to chronic excess of the bursal fluid, with thickening of the walls. This is especially common in certain situations—for example, in the knee and elbow. (See below, Occupation Diseases.)

*Beat Knee and Housemaid's Knee.*—Miners, housemaids, and others who kneel at their work, if they do not employ some soft cushion, are liable to an inflammation of the bursa overlying the prominent part of the leg-bone immediately below the knee-joint. Though usually quite painless unless pressed upon, it forms a soft fluid swelling, which may be as large as an orange, and projects below the knee. “Beat knee” is the term applied by miners to this inflammation of the knee bursa. [Figs. 55, 56.]

*Beat Elbow.*—The term used by miners for an enlargement of a natural bursa upon the tip of the elbow. The conditions are precisely the same as those of housemaid's knee. (For the other conditions of beat knee and beat elbow, see Beat Hand.) [Fig. 57.]

### Disease.

1. **Caused by the Accident.**—(a) *In the Bursæ themselves.*—The walls of the bursæ may become permanently thickened. The fluid may undergo changes, and form matter—*i.e.*, an abscess. If the fluid be chiefly blood, a hard mass of fibrous tissue may gradually take the place of the blood.

(b) *Disease caused by the Spread of Inflammation to Neighbour-*

*ing or Distant Parts.*—If matter forms in an injured bursa which communicates with a joint or tendon-sheath, the consequences will be a spread of inflammation to the joints or tendon-sheaths which may ultimately lead to such serious results as destruction of a joint or fixation of the tendons, preventing the free play of the muscles attached to them. (See Joints and Tendons.) Formation of matter in distant parts of the body may ensue (pyæmia).

2. **Existing before the Accident and aggravating its Effects.**—Bursæ are subject to tubercular, syphilitic, and gonorrhœal inflammation, which may spread to a neighbouring joint and cause serious consequences. Any injury to bursæ thus affected may aggravate the condition or determine its extension to neighbouring parts.

#### Operation.

Contusions of bursæ resulting in large effusions of blood may require operation if the blood is not quickly absorbed; if the formation of matter is threatened; or if a mass of fibrous tissue forms, causing pain, discomfort, or interference with occupation.

Wounds are treated on ordinary surgical lines.

The formation of matter in a bursa necessitates incising it widely and allowing it to heal up from the bottom. Chronically inflamed or irritated bursæ should be excised.

#### Cure.

(i.) **Contusions.**—Incision of a bursa and removal of clot will require ten days for the wound to close, but the part will not then be sufficiently sound to permit of the pressure and friction the localities of bursæ are subject to. For this a month should be allowed.

(ii.) **Wounds.**—The fact that the lining membrane secretes fluid may prolong healing by a week or so.

A bursa in which matter has formed, after it has been thoroughly opened, may take six weeks for complete recovery.

(iii.) **Continued Irritation: Chronic Bursitis.**—Chronically inflamed or irritated bursæ after excision will take fourteen days for the wound to heal.

To effect a complete cure excision is the proper treatment of housemaid's knee, beat knee, and beat elbow.

#### Return to Work.

(i.) **Contusions**, producing merely an excess of the natural fluid, may not prevent an injured man from working. If some

fluid is poured out, in consequence of which he is incapable of working, as soon as the fluid is absorbed, say in a week or fourteen days, the man can return to work.

(ii.) **Wounds.**—Simple—fourteen days.

Septic (matter having formed)—uncertain; probably in twenty-eight to thirty-five days, or earlier.

(iii.) **Continued Irritation: Chronic Bursitis.**—If not painful, there is no need to keep away from work.

(a) *Non-Operative.*—If painful, palliative treatment may be indefinitely prolonged without success.

(b) *After Excision.*—Twenty-one days.

(c) *Beat Knee.*—Of fifty-two cases of beat knee, the average period of incapacity was twenty-four days.

### Recurrence.

A bursa which has been inflamed and successfully treated is, nevertheless, subject to recurrence of inflammation in some instances; hence the importance of excision to effect a complete and permanent cure.

### Occupation Diseases.

(a) **True Bursæ.**—Certain occupations entailing intermittent pressure and friction produce the chronic inflammation of particular bursæ; such are housemaid's knee, miner's elbow, beat elbow, beat knee. Slaters, weavers, cab-drivers, joiners, glass-polishers, and parquet-layers, commonly suffer in this way.

(b) **False Bursæ.**—False or adventitious bursæ form owing to incessantly repeated pressure or movement over some bony prominence, and are seen in timber-porters, cobblers, weavers, etc.

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*For legal cases of Beat Elbow, Beat Hand, and Beat Knee, see*  
CASE GUIDE: *Bursæ*.

## CAISSON DISEASE.\*

By FREDERICK E. BATTEN,

M.D., F.R.C.P.,

Physician to the Hospital for Sick Children, Great Ormond Street; Physician to Out-Patients, the National Hospital for the paralyzed and Epileptic, Queen Square.

### Head-note.

CAISSON disease is dangerous because it produces various nervous symptoms; of these the most serious is paralysis, usually temporary, but sometimes permanent.

### Technical Terms.

*Air-lock*.—An air-chamber, part of a caisson, so arranged that workmen after entering it can be subjected to increase or decrease of atmospheric pressure.

*Caisson*.—A caisson is essentially a spacious tube, or diving-bell, which can be sunk vertically in the water, the end of which is cut off by a partition to form a chamber into which the compressed air is pumped. From this chamber there is a shaft, and at the end of the shaft another small chamber called the "air-lock," which can be cut off from the shaft by traps and valves. The workmen enter the lock, the door is closed, and the air forced in; when the pressure has risen to that of the rest of the system, the trap to the shaft can be opened, and the man pass to the working chamber. The greater the depth under water at which the work has to be executed, the greater is the atmospheric pressure in the bell or caisson. Men have worked under a pressure of  $4\frac{1}{2}$  atmospheres for 8-hour shifts, but numbers of the men suffered, and the shifts had to be shortened. Hill and Macleod suggest that with a pressure of 2 atmospheres the shifts should be 4 hours, and decompression should last for  $\frac{1}{2}$  to 1 hour; with a pressure of 3 to 4 atmospheres (45 to 60 pounds to the square inch), a 4-hour shift and 1 to 2 hours' decompression; with a pressure of 5 atmospheres (75 pounds to the square inch), the shifts

\* A disease which is included in the third schedule of the Workmen's Compensation Act, 1906.

should be 1 hour, and there should be 2 hours' decompression; with 6 to 7 atmospheres, the shifts should be  $\frac{1}{2}$  hour and the decompression 2 hours. The higher the compression, the shorter should be the shifts and the longer should be the period of decompression. A good general rule which should be adopted for decompression is, "Never more rapid than a minute per pound over atmospheric pressure."

### Effects of Increased Atmospheric Pressure.

When a man is at work in air under compression, an increased quantity of atmospheric air is taken up by the fluids of the body in a condition of simple solution. On removal of the increased pressure, this dissolved air escapes in bubbles into the tissues and produces the symptoms of the disease.

True compressed air illness occurs during or after decompression. By far the most common symptom is pain in the extremities, known by workmen as "bends." The knees, elbows, and shoulders, are most usually effected. The pain may be so severe that it interferes with the use of the limbs to such an extent that the man may be described by the casual bystander as suffering from paralysis.

Pains may pass off in one to two hours, or may last several days. If recompression is applied early, they may rapidly disappear.

The injuries which the ear may sustain if the tube from the throat to the ear (Eustachian tube) is not freely open are considerable; for this tube, by allowing the free entry of air from the throat to the ear, equalizes the pressure on each side of the drum (see Ear). The consequences of abnormal pressures, with the Eustachian tube closed, will be pain in the ear, or rupture of the drum; and even congestion about the lining cavity, producing hæmorrhage, deafness, auditory vertigo, and unsteadiness in gait.

The cerebral symptoms consist of headache, unconsciousness (coma), and transient paralysis of one side or of one limb (hemiplegia or monoplegia).

The spinal symptoms consist in pain, loss of power in the legs, retention of urine, which may be followed by inflammation of the bladder (cystitis).

Bleeding from the nose, ears, lungs, and back passage (anus) occurs.

The paralysis may occur immediately, or some hours after

decompression. The legs may be completely paralyzed, the knee-jerk may be absent, and there may be loss of sensation and loss of sexual power.

If recompression is immediately adopted, the symptoms may rapidly pass off.

The factors which predispose to an attack are—

1. Too long duration at high pressure.
2. Too rapid compression or decompression.
3. Active muscular exertion and exposure to cold after leaving the caisson.
4. Defective ventilation.

### Disease.

1. **Produced by Compressed Air and too Rapid Decompression.**—If the initial lesion has been very severe, permanent damage to the spinal cord may result.

2. **Accentuating the Effects of Caisson Disease.**—Corpulency, alcohol, fatigue, and a full stomach, all predispose to an attack of caisson disease, in addition to the causes mentioned above.

### Operation.

None required.

### Cure.

In cases not immediately treated, the symptoms may last for several days.

If the paralysis be at all extensive or complete, there is a distinct probability that recovery will be incomplete. In milder cases, when function has only been disturbed and not destroyed, recovery is generally complete in a few weeks.

### Return to Work.

In mild cases, after ten days to a few weeks the patient is able to return to work.

In very severe cases, partial paralysis being permanent, the man may never be able to return to his work.

### Recurrence.

There is no risk of recurrence of the effects of compressed air when once the symptoms have passed off.

**Occupation Diseases.**

Workmen and others who have to work under increased atmospheric pressure are liable to suffer from a variety of symptoms produced by the alteration in pressure. Of these, divers and those who work in caissons are most liable to suffer.

**Diagnosis.**

This is fairly obvious, in that the trouble follows so specifically upon too rapid decompression. In view of the possible effects of poisonous gases, inquiry must also be directed very specially to any symptoms that may have occurred during work, for, as a matter of fact, the symptoms of the disease do not occur during actual work.

In diving works, carbonic acid, carbon monoxide, sulphuretted hydrogen, and other gases, are occasionally encountered in poisonous quantities, and it may happen that a workman may be inclined to attribute the effects of these to compressed air. The symptoms are quite different, and no difficulty should arise in making a correct diagnosis.

**The Malingerer.**

It may be said that it needs an accurate knowledge of the disease to simulate it. The presence of good general health and the absence of all signs of organic disease would be points on which it was justifiable to assume that the disease was feigned.

The rate of decompression is a guide to the probability of the symptoms being caisson disease.

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**CARBON BISULPHIDE.***See* POISONS.**CATARACT.***See* EYE.

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**CELLULITIS, SUBCUTANEOUS, OF THE  
HAND AND KNEE.***See* BEAT HAND, BURSAE.

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**CEREBELLUM, CEREBRUM.***See* BRAIN.



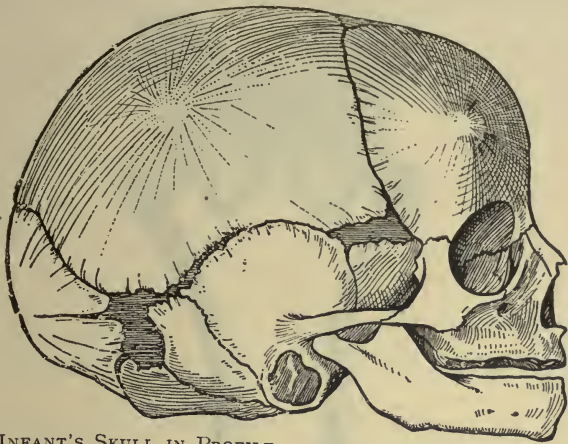
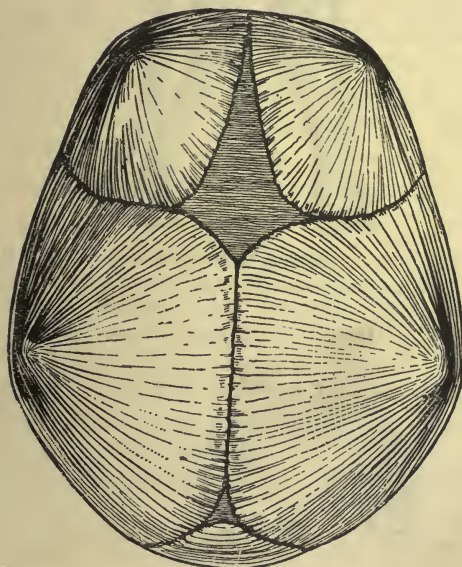


FIG. 58.—INFANT'S SKULL IN PROFILE, SHOWING THE PROCESS OF GROWTH OF THE BONES FROM THEIR CENTRES, AND THE MEMBRANOUS AREAS, FONTANELLES, WHICH AT BIRTH STILL SEPARATE THE DIFFERENT BONES WHICH EVENTUALLY UNITE TO FORM THE COMPLETE ADULT SKULL.

Notice that the teeth are not yet cut, and the ear-drum is close to the surface.

(From Buchanan's "Anatomy.")

FRONT.



BEHIND.

FIG. 59.—THE SAME INFANT'S SKULL AS IN FIG. 58, SEEN FROM ABOVE.

The large diamond-shaped area is the anterior fontanelle. The smaller triangular area behind is the posterior fontanelle.

(From Buchanan's "Anatomy.")

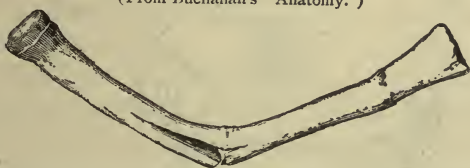


FIG. 60.—GREENSTICK FRACTURE: RADIUS OF A CHILD BROKEN ON ONE SIDE, AND BENT ON THE OPPOSITE SIDE.

(From Rose and Carless's "Surgery.")



FIG. 61.—HIP AND LEG BONES OF A CHILD WHO HAD SUFFERED FROM RICKETS  
The ends of all the long bones are enlarged, and the shafts have bent,  
producing "knock-knees."  
(From Rose and Carless's "Surgery.")

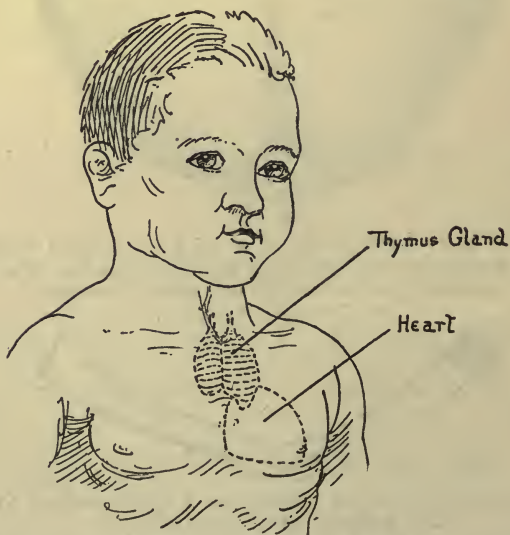


FIG. 62.—THE THYMUS GLAND OF A YOUNG CHILD IN ITS NORMAL POSITION,  
JUST ABOVE THE HEART.

# ACCIDENTS AND INJURIES IN CHILDHOOD.

BY THOMAS H. KELLOCK,

M.A., M.C., M.D. (CANTAB.), F.R.C.S.

Surgeon to Hospital for Sick Children, Great Ormond Street ;  
Surgeon to Out-Patients, Middlesex Hospital.

## Head-note.

CHILDREN, from the nature of their habits, whether it be from the irresponsibility of the infant or from the recklessness of the schoolboy, are particularly liable to accidents and injuries. Although these are often trivial, and quickly and completely cured, yet, on the contrary, serious results sometimes follow, which may end in deformity or disablement of lifelong duration.

## Technical Terms.

*Chorea (St. Vitus's Dance).*—A nervous affection causing involuntary repeated movements of the muscles, especially those of face and fingers. It sometimes seriously affects the heart.

*Hæmophilia (Bleeder's Disease).*—A congenital hereditary affection of the bloodvessels and blood, transmitted by mother to children, but, as a rule, only causing symptoms in males. It is characterized by a failure of natural arrest of bleeding when once begun.

## Anatomy.

Most of the structures of a child's body, being immature, are more delicate and susceptible to injury than those of an adult. On the other hand, certain parts—*e.g.*, the breast—being undeveloped, are rather less likely to be injured. Congenital defects or deformities are met with, and are liable to be mistaken for the results of accident or disease. The failure of the closing of some embryonic openings, and the absence, partial or complete, of bones or muscles, are examples of congenital abnormalities.

### Consequences of Accident.

Of the general or constitutional results of accidents, two—bleeding and shock—require special mention in the case of children. Children stand loss of blood badly; serious hæmorrhage will leave its mark in anæmia and debility for a comparatively-speaking longer time than in the case of adults. As few children survive the disease, it is during childhood that cases of hæmophilia are most often met with. (See below, Disease.)

The primary or immediate shock that follows an accident is generally felt seriously by children, for, in addition to the injury itself, there is often a moral sense of disgrace, a feeling that they may be blamed, which adds materially to the effect of the injury. Secondary shock, on the other hand—that which occurs after an interval of time, and which is often so marked in adults—is rarely, if ever, seen in children.

### Disease.

1. **Produced by the Accident.**—In susceptible children, one of the results of an accident may be to produce nervous debility, which may persist for a long time. This is characterized by such symptoms as night-terrors or sleep-walking. This condition is said to result in genuine chorea (St. Vitus's dance), but this more frequently appears from witnessing an accident to another than from the child itself suffering personal injury. Septicæmia, or blood-poisoning, tuberculosis, tetanus, or lockjaw, etc., are all constitutional affections which may result from an accident, but there is no special feature in these diseases if they occur in childhood.

2. **Existing before the Accident and aggravating its Effects.**—In addition to hæmophilia, mentioned below under Injury to Vessels, the latent diseases which an accident is specially apt to bring to light in a child are tuberculosis, congenital syphilis, and blood-poisoning. These effects are most often seen in cases of injury to bones.

### Operation.

As a rule children stand operations as well as adults. More care has to be exercised, perhaps, in keeping them warm during the performance of operations, for the effects of undue exposure are very marked. Chloroform is almost always used as the anæsthetic for children, either pure or mixed with alcohol

and ether. They generally take it well, and fatalities from the anæsthetic itself in skilled hands are rarer in children than in adults. (See Anæsthetics.)

#### Cure.

On the whole, the time for surgical cure after an injury is about the same in a child as in an adult; for although their tissues tend to heal more quickly, there is often a difficulty in keeping children still. Half-measures or partial rest cannot well be obtained with them, and so they have to be given either complete rest or unfettered freedom.

#### Return to Work (School).

The return to work of the adult has its analogue in return to school of the child. As a child generally takes but little care of himself when he returns to school, it is often necessary to keep him away longer than an adult would be kept from his ordinary occupation.

#### Recurrence.

The risk of recurrence of the consequences of an accident are less in a child than in an adult, for his growing powers tend to obliterate the effects of an injury. Chorea (St. Vitus's dance) is an exception, as it is apt to recur from quite a trivial shock after a period of apparently complete cure.

#### Diagnosis.

The diagnosis of the effects of an accident is sometimes a matter of great difficulty, for in the case of young children little or no help can be obtained from them, and, as in dumb animals, conclusions have to be drawn entirely from what can be observed. The history of the accident and of the symptoms that immediately followed have to be obtained from others, perhaps the parents; and in a case where another person is blamed their evidence may not be quite unbiassed.

#### Malingering.

Malingering, in the real sense of the word, is rare in children, who, except when under undue influence on the part of their elders, are not prone to exaggerate the results of an injury. At the same time, it is not at all uncommon to find them the subjects of what is known as "hysterical" or "functional" conditions, in which there is a physiological inability on the part

of the body to perform its proper functions, although the real cause for this inability may not be apparent. These conditions are, however, quite real to the child, and are almost always the sequel to some previous affection or injury. The injury may be recovered from while the effect of it remains. For example, as the result of some slight inflammation of a joint, which is long since recovered from as far as the injured part itself is concerned, complete fixation of the joint, sometimes in most peculiar positions, may be met with. A former affection of the stomach or intestines may leave a want of power of swallowing. Such conditions are none the less real to the patient because their treatment and cure are comparatively easy matters, and they should never be mistaken for malingering.

Neither is mimicry malingering, for it is seldom practised by the children with any ulterior motive. It is hardly likely to be the result or consequence of any injury, and is, as a rule, easily recognized. The child who copies the deformity or tricks of another does so gradually, and such a habit is more likely to be the result of a want of equilibrium in a developing brain than of innate wickedness. It rarely lasts long, and is more easily cured by patience and kindness than by more stringent methods.

### **Criminal and Self-inflicted Wounds.**

Criminal and self-inflicted wounds are comparatively rare in children, and call for no special mention, except in the case of the genital organs, under which they will be referred to. The intentional maiming of children is said to have been practised by beggars to attract the sympathy of the charitable.

### **THE ABDOMEN.**

(For Rupture, see below.)

#### **Head-note.**

Injuries to the abdomen are comparatively rare in children. When they occur they are, of course, serious, and often accompanied by a great deal of shock. They present few features which are not also met with in the case of similar injuries to adults, with the exception of intussusception, which is common in childhood.

### Technical Terms.

*Intussusception*.—The telescoping of part of the bowel into that immediately below. This is generally found at the junction of the large and small bowel. [Figs. 111, 112.]

*Péritonitis*.—Inflammation of the peritoneum, the membrane that covers the bowels and the inside of the abdominal wall.

### Anatomy.

There is no special feature in the child's abdomen worthy of mention here, except defects causing rupture. (See Rupture.)

### Consequences of Accident.

Intussusception has been attributed to injury. It is a common affection without any injury, and generally occurs in quite young children that are otherwise healthy, but if it is not immediately treated it is generally fatal. Its cause is rather obscure, but it has been thought to be sometimes due to a slight injury of a small part of the wall of the bowel, which is then drawn in and passed onwards by the muscular contraction of the uninjured part. (See Intestines.) [Figs. 111, 112.]

### Disease.

1. **Caused by the Accident**.—There is nothing special.
2. **Existing before the Accident and aggravating its Effects**.—Any inflammation or disease existing before an accident would aggravate the patient's condition. (See below, Diagnosis.)

### Operation.

In the case of intussusception an operation is generally the only means of cure. This is a serious one, as it involves the opening of the abdominal cavity and the replacing of the displaced bowel, a proceeding which entails considerable risk to the life of a young child.

There is also a risk, as in all cases of operation wounds in the abdomen of young children, for the wound to give way some days after the operation, a contretemps which is serious but not necessarily fatal.

### Cure.

After the operation for intussusception the cure is generally complete in from two to three weeks.

**Recurrence.**

There is little risk of recurrence of any of the above consequences of accidents.

**Diagnosis.**

The condition for which the intussusception is most likely to be mistaken is some acute inflammation of the inside of the bowel. The presence of a tumour which can be felt in the abdomen is most characteristic of intussusception, together with the passage of blood from the bowels.

Children are particularly liable to tuberculous affections of the peritoneum and of the abdominal glands. A trifling injury may direct the attention of the child's parents to see a disease. The cause is said to be, generally, the infection by tuberculous milk.

## ALCOHOL—ANÆSTHETICS—APPENDIX.

There is nothing special to note in children in connection with these, but for the behaviour of children under anæsthesia, see Anæsthetics.

## BLADDER.

**Anatomy.**

The bladder is occasionally the seat of congenital malformations, which could hardly be mistaken for the consequences of accident.

**Disease.**

**Existing before the Accident and aggravating its Effects.**  
—Children sometimes suffer from stone in the bladder, which might render the consequences of an accident in that region more serious.

## THE BONES.

(For Spinal Bones, see Spine.)

**Head-note.**

The important point to consider in connection with injury to the bones of children is the fact that, as the bones are growing, an injury may cause such a disturbance to the process of growth that the bone remains permanently short or deformed.



### Technical Terms.

(For other Technical Terms, see Bones.)

*Rickets*.—A constitutional disease of childhood caused by improper feeding. The bones are softer, and the cartilages at each growing end are enlarged. In consequence of the soft character of the bones, they yield to pressure, so that the ribs and the long bones become bent. [Fig. 61.]

*Scurvy Rickets*.—A combination of slight rickets and scurvy—a disease associated with improper feeding. Bleeding occurs in different parts of the body, particularly from the gums and into the sheath of the bones (periosteum).

### Anatomy.

A bone grows in its circumference from the bone-sheath (periosteum) by a continual laying down of new bone upon the surface of the old. In addition, at each end of the bone is usually the cap of cartilage which separates the ends of the bone, the epiphyses, from the central part. These caps of cartilage allow the bone on each side of them to continue growing up to a certain time, which is at the latest about the age of twenty-five, when they unite. (For the Development of Bone, see Bones.)

### Consequences of Accident.

Children suffer from fractures of bones in exactly the same way as adults, but there are certain points which are distinctly characteristic of injury to bones in children.

(i.) **Simple or Uncomplicated Fracture**.—The characteristic of a fracture occurring in a child's bone is that, if it is not of the next variety, it is often almost completely transverse, and not, as in adults, oblique. One result of this is that, if properly set, very little if any shortening of the limb should result. Children's bones are generally broken by direct violence—*i.e.*, violence applied to the spot where the bone breaks.

(ii.) **Greenstick Fracture**.—When violence is applied to the child's bone, it either produces the condition next to be discussed, or the bone bends and breaks like a green stick—that is, only on one side. Attempts to straighten generally fail, or produce a complete fracture. This form of fracture is most common in the collar-bone and in the bones of the forearm. [Fig. 61.]

(iii.) **Separation of the Epiphyses**.—If indirect violence, or leverage, is applied to a child's bone, it generally separates the

bone into its component parts—*i.e.*, it causes a separation of the epiphyses or growing ends of the bone from the shaft or long part of the bone.

This forms an injury peculiar to children, or to those who have not yet reached an age at which all the component parts of the bone have united to form one solid whole. That is to say, that at any time before an “epiphysis” is joined on to the main bone it is liable to be separated from it by violence. [Fig. 18.]

Special fractures are dealt with under the head of Cure.

(iv.) **Injury other than Fracture** (*e.g.*, **Bruising**).—Owing to the comparatively soft and very vascular condition of a growing bone, it is easily bruised. Bruising may cause bleeding in the bone-sheath (periosteum), and this be followed by the irregular formation of new bone in the position of the poured-out blood, leaving an irregular prominence for a long time. This is most frequently seen on the head, where, as the result of long pressure during birth, blood is often poured out on to the surface of the skull, producing a condition known as “caput succedaneum” (cephalhæmatoma), which occasionally forms irregular bone.

### Disease.

I. **Produced by the Accident.**—The following are the conditions of disease which may arise after injury to bones in children :

(a) **Necrosis** (Death of Part of the Bone).—Acute necrosis is a disease almost peculiar to children and young adults, and generally follows some slight injury to the bone. A condition of inflammation is set up accompanied by the formation of matter, which sometimes produces death of the bone to such a degree that in a long bone the whole of the shaft may separate as a dead piece. It may affect any bone in the body, but is most common at the lower end of the thigh-bone and just below the knee. The disease frequently spreads into the neighbouring joints, which it destroys. The condition is a very serious one, and it is often years before the dead bone can all be taken away. The destruction is sometimes so extensive that amputation is necessary to save the child's life. [Figs. 21, 22, 23.]

(b) **Tuberculosis.**—A history of an injury is often given in cases of tuberculosis of the bone in children. Inflammation commenced, and this was followed by an abscess. The epiphyses are the most common locality for this affection, and

the disease may find its way into the joint, producing more or less permanent damage.

(c) **Excessive Callus.**—After the healing of a fracture excessive callus may occur in children, but it disappears in time.

(d) **Inflammation of the Epiphyses.**—When an epiphysis has been injured or separated, it generally happens that the cartilage which was present between it and the main bone ossifies as healing takes place, and in consequence all further growth of the bone in length at this spot ceases. This is, of course, of much greater importance in the leg than in the arm, as it produces shortening of one leg and lameness in consequence.

(e) **Tumours.**—See Bones.

A sarcoma sometimes develops at the site of fracture, especially when the callus has been excessive. This is a very serious condition. (See Operation.) After amputation the tumour is likely to recur in the lungs or other parts of the body. The time after an injury at which a sarcoma may occur is difficult to fix, but it generally occurs within a few weeks after the fracture.

(f) **Paralysis (Ischæmic Paralysis).**—This condition is rarely met with in adults. It occurs after fractures of the bones of the forearm, or just above the elbow. It consists in contraction of the muscles in the front of the forearm, so that the fingers become closed and the hand bent on the wrist. It is supposed to be caused by pressure on the muscles, and from subsequent swelling of the arm. It is a very serious condition, for if it exists in more than a slight degree treatment is of little use, and permanent deformity of the hand and forearm results.

2. **Existing before the Accident and aggravating its Effects.**—The following diseases affect injuries to bones in children: Rickets, scurvy rickets, syphilis, and mollities ossium.

(a) **Rickets.**—The bones in rickets are soft and generally ill-formed, and consequently are predisposed to fracture. The fracture is usually of the greenstick nature. [Fig. 61.]

(b) **Scurvy Rickets.**—In children suffering from this affection the very slightest injury will often produce great bleeding in the bone-sheath, or periosteum. The blood may spread round the bone, stripping the periosteum for a considerable distance, even reaching to the epiphyses, and causing their separation from the rest of the bone.

(c) **Syphilis.**—In congenital syphilis the bones of children, after they have reached the age of three or four years, are harder and denser than normal. They are not so easily broken, but they

are very liable to attacks of inflammation, and slight injury may cause necrosis in them.

(*d*) **Mollities Ossium** (also known as *Fragilitas Ossium*).—This is a general disease of childhood, and is not the same affection as occurs in adults under the same name. As its name implies, it is characterized by softness of bones. The long bones will break spontaneously at an early age, or from very slight violence, and this disposition to fracture will persist throughout life. Oddly, union takes place fairly easily after fractures in this disease. No known treatment is of any avail for it.

### Operation.

Operation after injury to a bone is not more often called for in a child than in an adult. For the proper setting of a fracture in a child, chloroform is often necessary to relieve the pain, especially in greenstick fracture, when a deformity has to be corrected. As has been mentioned above, the result of an attempt to straighten a greenstick fracture is generally to produce a complete fracture, which is then treated in the ordinary way. The removal of dead bone by operation may be necessary, and should sarcoma of the bone occur an immediate amputation at the first joint above the disease is imperatively called for. In the case of great loss of bone in consequence of necrosis, new bone can sometimes be grafted into the space, this new bone being usually taken from some recently killed young animal. Where an epiphysis which is near to or involves a joint has become separated, to move the joint and prevent fixation, chloroform will have to be administered, for these movements are exceedingly painful.

### Cure.

Children's bones unite rapidly if the bones are set in the proper position, and the length of time necessary for their union is rather shorter than in the case of adults. In the case of separation of an epiphyses which is very near to or is part of a joint, the length of time before a complete cure results is often several months.

### Special Fractures.

1. **The Skull.**—Fractures of the skull in children deserve special notice. The skull is comparatively thin, more elastic, and the several bones that compose it are less firmly connected

to each other, than in adults. A blow or fall on the head of a child may cause a depression of the bone, while in an adult the same injury would probably have caused a fracture. In a child such a depression is often nothing but a bending inwards of the bone. It causes no symptoms, and in course of time gradually returns to its former position, or leaves a depression which apparently does no harm except as regards appearance. These favourable consequences will not always follow the infliction of injuries to the skulls of children, for they may suffer in exactly the same way as an adult.

2. **The Spine.**—The spines of children are liable to the same injuries that occur in adults. (See below, Disease.)

3. **The Ribs and Sternum.**—The ribs are wonderfully elastic in a child, as is often demonstrated by the result of accidents. Such a serious injury as the wheel of a cab or cart passing across the chest of a child may cause no fracture of the ribs, and yet cause such serious injuries to the internal organs as rupture of the lungs, heart, or large vessels.

4. **Fractures of the Limbs.**—The usual forms of these have been discussed above under the head of Fractures, and, as has been said, it is at the ends of the long bones that separation of the epiphyses occurs.

#### Recurrence.

Sarcoma is very apt to recur elsewhere, even after the original growth is early removed by operation.

#### Diagnosis.

Syphilis, rickets, scurvy rickets, and mollities ossium are the important points to be remembered in diagnosis.

Pre-existing rickets can generally be recognized by enlargements at the junction of the epiphyses with the long bones (especially about the wrists), the large square head, deformed chest, bony lumps on the ribs, and late appearance of teeth. Scurvy rickets is generally met with in children under one year of age; anæmia, general tenderness of the bones, and bleeding into the gums, if any teeth are present, are the general symptoms.

Congenital syphilis in children over two or three years of age may cause an ill-shaped head, depressed nose, a peculiar notching of the incisor (permanent) teeth, and slight thickening of the long bones, especially those of the legs.

In mollities ossium the chief points in diagnosis are the history of fractures at an early age, caused by little violence, the presence of evidence of fractures that have united, and possibly the history of the same condition in other members of the family. Separation of the epiphyses must be carefully distinguished from dislocation. Dislocation is rarer in children; separation of the epiphyses is very common.

**X-Ray Diagnosis.**—No account, however short, of injuries to bones and their results in accidents is complete without a word of warning as to the inferences to be drawn from skiagrams and examinations with the fluorescent screen. This is especially so in the case of children. Recent callus and the cartilaginous ends of the bones throw very faint shadows when examined in this way, and it is both easy and common for those not skilled in the interpretation of what is seen by these methods to fall into serious error as to the condition of the parts, and the younger the patient is the more likely are mistakes to occur.

## THE BRAIN.

### Head-note.

In children convulsions or fits take the place of the shivering attacks (rigors) which sometimes accompany a rapid rise of temperature in an adult.

### Technical Terms.

*Föntänëlle.*—Small areas of membrane between the bones in a newly born child's head. In course of time the bone grows in and takes the place of the membrane. [Figs. 58, 59.]

*Hýdröcëphälus* (Water on the Brain).—A head distended by an excessive quantity of the natural fluid round and inside the brain.

*Mëningitis.*—Inflammation of the coverings of the brain.

### Anatomy.

During the first year of a child's life its skull is not uniformly bony, but is made up of plates of bone and membrane supported by cartilage. Where there are large areas of membrane they form spots called "fontanelles," the largest of which is at the top of the head. [Fig. 59.] There are numerous deformities in connection with the child's brain, but they require no consideration here.

### Consequences of Accident.

Children do not easily suffer from concussion in consequence of blows on the head; but should they become unconscious as the result of a blow, they are generally seriously hurt and recover slowly. Their brains are particularly tolerant of widely-spread pressure, such as occurs from an injury producing bending in of the bones of the skull, and what appears to be a serious depression from the outside of the skull is often unattended by any evidence of harmful pressure on the brain. The brain of a child may be injured during birth or in childhood from blows.

For the effects of injury during birth, which is chiefly caused by bleeding upon the surface of the brain, see below, Disease.

### Disease.

1. **Caused by the Accident.**—(i.) *During Birth.*—Injury to the brain of a child during birth, producing a clot of blood, is often considered the cause of the condition known as “spastic paraplegia,” in which there is a contraction of the muscles of various parts of the body. Children the subjects of this affection generally have small heads and deficient intellects.

(ii.) *Mental Disturbance.*—Any serious injury to the brain of a child may be followed by a long period of mental apathy continuing for years, and so interfering with his education or learning of a profession or trade.

(iii.) *Tuberculous Meningitis.*—It is rather a vexed question as to how far an injury to the head may be the cause of tuberculous meningitis. It is doubtful if such is the case, for there is little or no evidence to prove that tuberculous meningitis is ever set up by accident.

2. **Existing before the Accident and aggravating its Effects.**—Excessive quantities of the natural fluid in the head are sometimes present in children at birth, and a condition known as “hydrocephalus.” This would aggravate the effects of any injury to the head.

### Operation.

Children bear operations upon the brain as well as adults.

### Cure.

The time necessary for the effects of an injury to the head to pass off is probably about the same as in adults, but in the case

of the child it is rather more difficult to determine when they have completely recovered.

### Diagnosis.

One of the very commonest forms of disease in childhood is inflammation of the ear, which may occur after any of the fevers, especially measles. This produces an ear discharge the ultimate consequences of which may be inflammation of the brain. If this occurred in a child who happened to have been struck, a claim that it was caused by injury might be made, though a blow has nothing to do with the disease of the brain. (See Ear.)

The most important point in connection with diagnosis of injuries to the child's brain is to distinguish between tuberculous meningitis and the consequences of an injury.

Tuberculous meningitis has been mentioned above as probably not caused by injury, and, as it is usually fatal, a diagnosis can be made for certain after death.

## BREAST AND BURSÆ.

There is no special feature connected with accidents to breast and bursæ in children.

## COLD.

Children are extremely sensitive to cold. Especial care has always to be taken that their bodies are not unduly exposed during an operation, as they very easily contract pneumonia under such circumstances.

## THE EAR.

### Head-note.

Accidents to the ear are comparatively common in children. They are apt to be followed by deafness, or, at any rate, impairment of hearing, and possibly by inflammation, which may spread to the brain and other vital parts. (See Brain.)

### Anatomy.

The canal of the ear is rather straighter than in adults, and the facial nerve (which passes through the internal parts of the ear), on the integrity of which the power of movement in the muscles of the face depend, is covered, as it lies in its



bony canal in the middle of the ear, by a thinner layer of bone than in the adult, and thus is more easily affected by spread of inflammation.

### Diagnosis.

Congenital syphilis is a common cause of deafness in childhood. The effects of this must not be mistaken for injury.

Discharge from the ear is an exceedingly common disease in children without any accident whatsoever. It commonly appears after one of the infective fevers, especially measles.

## EYE.

### Anatomy.

Except some congenital defects, there is nothing characteristic about the child's eye.

### Disease.

#### Existing before the Accident and aggravating its Effects.

—Children frequently suffer from inflammation of the conjunctiva, one form of which (ophthalmia neonatorum) appears soon after birth; this latter form is usually due to disease, not accident.

Opacities of the cornea are also common in children. These may be due to previous ulceration or congenital syphilis.

### Diagnosis.

These diseases might be mistaken for the consequences of accident, or intentionally attributed to accident by fraudulent relatives.

### Criminal and Self-inflicted Wounds.

Beggars have been known to blind the eyes of children for the purpose of appealing to the sympathy of the charitable.

## FASCIÆ.

There is no special point concerning fasciæ in childhood.

## GANGRENE.

See Gangrene—Noma.

## THE GENERATIVE ORGANS—FEMALE.

**Anatomy.**

The female external genital organs are not infrequently the seat of congenital deformities. The most common are—

1. Occlusion of the front passage, or vagina. This may persist unnoticed till the time when the menstrual period should commence, when the menstrual fluid may be retained and dilate the internal parts. An injury happening then may produce an external or internal bursting of this, with most serious results.

2. An opening between the rectum and vagina (congenital recto-vaginal fistula), which may be associated or not with the absence of the anus. This opening might possibly be mistaken for the result of an injury, such as penetrating wound with a stick. (See Genital Organs—Female—of Adults.)

**Diagnosis.**

It is of very great importance to remember that young girls especially those in a low condition of health, are liable to an inflammation of the vagina, which produces a discharge of matter, but which is not gonorrhœal in origin; and when such a condition has been discovered by the mother, it has often been the cause of unfounded accusations. It is only the discovery, by skilled examination, of the actual organisms of gonorrhœa in the discharge that can be taken as direct evidence of the existence of this disease.

**Criminal and Self-inflicted Wounds.**

Especial importance attaches to the criminal injuries of the genital organs in female children. An assault by a healthy man may do no harm beyond a bruising of the parts and rupture of the hymen, conditions which are as a rule easily recovered from. Should, however, the man be suffering from any venereal disease, this may be communicated to the child with all its attendant dangers. The symptoms of gonorrhœal infection would be an inflamed condition of the vagina with discharge of matter, in which, on microscopical examination, the specific organism causing the disease will be found.

## THE GENERATIVE ORGANS—MALE.

**Anatomy.**

The testicles are developed, in the first instance, in the abdomen near the kidneys, and gradually make their way down

to the scrotum, where they should normally be found at birth. Defects in their descent occur in two ways :

1. They may incompletely descend, or not at all.
2. They may descend into an abnormal position, on to the lower part of the abdomen, into the thigh, or into the perineum ; in the former case (1) they are often ill-developed and functionless.

### Consequences of Accident.

Bruising of the testicle is particularly liable to occur if the organ is incompletely descended, as it then often lies in close proximity to the bone.

**Paraphymosis.**—This is a condition in which the foreskin is drawn back and cannot be put forward again. This may be associated with an accident, and causes much swelling of the parts. It generally requires a small operation for its relief.

### Disease.

**Caused by the Accident.**—Bruising of the testicle of any serious degree is apt to be followed by wasting (atrophy) of the organ, which thus becomes permanently functionless. Atrophy of the testicle may, however, follow any inflammation, especially that which sometimes occurs as a complication of mumps, and also sometimes follows a twisting of the cord of the testicle, a condition which occurs without injury.

Urethral fistula, or an artificial channel in the penis through which urine escapes, is a fairly common and serious result of tying strings, etc., around the penis. The pressure causes ulceration, which eats its way, so to speak, into the urethra.

### Operation.

**Paraphymosis** is a condition which is easily cured by a simple operation, but it generally calls for subsequent circumcision.

**Urethral Fistula**, if not treated by operation, is generally permanent. Some of the urine, and later in life the semen, pass through the abnormal opening, and it may thus be the cause of sterility. The operation for its cure is generally difficult, and not always satisfactory.

### Criminal and Self-inflicted Wounds.

The self-inflicted injuries of the penis generally consist in the passing of rings, rigid or elastic, over the organ. If they cannot be taken off, great swelling may ensue. Sometimes the con-

stricting body is only found when an operation is performed. Paraphymosis is sometimes caused by the child, sometimes by a companion.

Criminal injuries generally consist of the tying of strings around the organ. The writer has known of a case where some schoolfellows tied a string tightly round the penis of a small boy, tied the string to a railing, and then dragged the child backwards, with the result that the greater part of the organ was torn off.

In another case a boy was brought to the hospital with a piece of cotton which had been tied tightly round the penis, and partially divided it. The child, on being questioned, said the mother did it because he wetted the bed. The mother said the child did it himself for amusement. In such a case it is almost impossible to get at the truth.

#### GLANDERS.

Glanders has not been observed to bear any special relationship to childhood.

#### THE HEART.

##### **Anatomy.**

A congenital deformity, an opening from one side of the heart to the other, is found in children, and there are also other congenital abnormalities; they all tend to mix venous and arterial blood, the consequence of which is that the child is blue in the face from imperfect aeration of blood, and usually dies young.

#### HEAT (BURNS).

##### **Consequences of Accident.**

Burns and scalds in children, to which they are particularly liable, are more serious than in adults, especially on the head, chest, and abdomen. The immediate result is severe fright and shock, the shock being dependent upon the extent of surface which is burned rather than the depth to which it extends. After such severe injury the child may succumb within a few hours. Should he survive this, the period of recovery may be protracted, and the child will suffer greatly from the pain of the raw surface and the necessary dressings.

**Disease.**

**Caused by the Accident.**—Burns on the head may be followed by meningitis.

**Burn Rash.**—A few days after an extensive burn it is not at all uncommon for a rash to appear, accompanied by high fever. This rash closely resembles scarlet fever, for which it is frequently mistaken.

**Deformity from Contraction of Scars.**—This frequently occurs, and as the scar in a child is softer and more elastic than that in an adult, the deformity may be mitigated, or even cured, by careful and proper treatment.

**Operation.**

Where dressings are very extensive after a severe burn, it is occasionally necessary to administer an anæsthetic on account of the pain. Skin-grafting is also necessary in some cases.

**Recurrence.**

The scar after a burn or scald is very liable to break out into sores or ulcers in consequence of slight injuries. These ulcers are very slow and difficult to heal.

**INFECTIOIN.**

There is no point in connection with children as regards infection.

**INTESTINES.**

See above, Abdomen.

**JOINTS.****Consequences of Accident.**

**Dislocations.**—Boys about the age of six to thirteen are especially liable to dislocations at the elbow-joint, an injury which is as a rule easily remedied, and generally leaves no ill-effect in after-life.

Dislocation outwards of the kneecap (patella) is not an uncommon accident in young adults. It may be the result of a blow when the knee is fully extended. (See below, Disease.)

Fractures of bones and separation of the epiphyses, extending into the joint, have special importance, not only on account of the shortening of the limb that may be produced (see p. 213),

but also on account of the impairment of the use of the joint that may follow. The injuries set up inflammation of the joint, which makes movement afterwards limited. It is often very difficult to get the fragments of bone in these situations into good positions, and the projection of such unreduced pieces may subsequently mechanically interfere with the movements of the joint. This is especially noticeable in injuries about the elbow-joint.

Should the fracture be compound—that is, associated with a wound which leads into the joint—the joint will almost certainly become fixed.

### Disease.

1. **Caused by the Accident.**—Fixation of joints has already been mentioned above.

2. **Existing before the Accident and aggravating its Effects.**—**Hæmophilia.**—In this affection slight injuries will cause bleeding into a joint. The blood is generally absorbed again after a time, but constant recurrences are to be looked for after trivial injuries, and in consequence the joint becomes more or less fixed.

**Tubercle.**—As in the case of bones, injury to a joint may be followed by tubercular disease, but this can only occur if the child already has the germs of tubercle in the body. Joints as well as bones that have been previously affected by tuberculous disease, more especially if it should have been complicated by septic inflammation, are very liable to have the trouble restarted by an injury, even when it seems to have been in a perfectly quiescent or “apparently cured” condition.

**Infantile Paralysis.**—The consequences of this include slackness and weakness of the ligaments and tissues supporting a joint.

**Congenital Malformation.**—An hereditary malformation of the bones at the knee is sometimes found in several members of the same family, which enables injuries to produce dislocation of the patella. (See below, Diagnosis.)

### Recurrence.

After dislocations in children the risk of recurrence seems exceptionally small, and unlike what is seen in the case of adults. It is rare to find disease arising in a child’s joint after a dislocation.

**Diagnosis.**

**Congenital Dislocation.**—This condition is often found at the hip, the head of the thigh-bone not occupying the cavity in the side of the pelvic bone. It is sometimes found on one side, sometimes on both sides, and occurs much more frequently in girls than in boys. It is a true congenital deformity, and not due to injury during birth, as was previously supposed; for it is hereditary, and is sometimes found in more than one member of a family. It produces shortening of the limb and a lame, awkward gait, and might possibly be taken for the result of an injury.

**KIDNEY.**

There are congenital malformations of the kidneys, but otherwise there is nothing special about the kidney in children.

**THE LIVER.****Anatomy.**

The liver is relatively larger in children than in adults, but no special consequence has been noticed to follow this anatomical condition.

**THE LUNGS.****Anatomy.**

Before birth there is no air in the child's lungs. This condition is described as atelectasis. Although at birth a child takes air into its lungs, which thereby expand, the expansion may be incomplete, and portions of the lung remain in an unexpanded condition.

MUSCLES—ŒSOPHAGUS—PANCREAS—  
PERITONEUM (SEE ABOVE, ABDOMEN)—POISONS—  
PTOMAINES—RABIES.

There is nothing characteristic of childhood in these sections.

**THE NERVES.****Consequences of Accident.**

An injury which divides an important nerve of a child is serious, on account of the very small size of the divided nerve. In consequence, permanent disability is apt to result from the

non-union of the cut ends. (See also Bones—Ischæmic Paralysis, p. 215.)

### Diagnosis.

Children suffer from various forms of paralysis, which must be clearly distinguished from the results of an injury.

(a) **Diphtheritic Paralysis.**—After diphtheria the palate, diaphragm, and legs are frequently paralyzed, in consequence of which food may come through the child's nose, or the child may breathe with difficulty or be unable to stand. It may fall, through its inability to stand, before the paralysis is discovered, and then the paralysis may wrongly be said to be due to the fall, instead of the fall being due to the paralysis.

(b) **Infantile Paralysis (Acute Anterior Poliomyelitis).**—This disease due to an affection of the spinal cord in childhood, produces paralysis which may be very extensive at first, involving, perhaps, both arms and both legs, but which usually tends to improve, though it may leave one leg permanently paralyzed and wasted. The results of this disease may be wrongly attributed to injury.

(c) **Hip-Joint Disease.**—The stiffness, pain, and possible wasting of muscles, caused by tubercular disease of the hip must not be confounded with either disease or injury of the nerves of the legs.

### THE NOSE.

Swellings at the back of the nose (adenoids) are common in children; they obstruct the breathing and give the child a vacant expression.

Flattening of the bridge of the nose is met with as the result of accident, or it may be due to congenital syphilis.

Discharges from the nose may be due to inflammation, tuberculous disease of bones, congenital syphilis, diphtheria, or the presence of some substance pushed into a nostril.

### RUPTURE (HERNIA).

#### Anatomy.

Ruptures occur in children in three situations:

1. **In the Groin (Inguinal).**—These may be congenital or acquired. The congenital variety of inguinal hernia is fully discussed under Adult Hernia (see p. 692). It is caused by descent of the contents of the abdomen into a pouch, or sac,



present from before birth. In the acquired variety, the piece of bowel being forced out of the abdomen makes a new sac for itself, but in the groin this practically never occurs in children.

2. **At the Navel (Umbilical).**—This, too, may be congenital or acquired. At the navel the rare congenital variety is a defect of development, a part of the intestine having been left at birth inside the umbilical cord.

The acquired variety is much more common, and is due to the protrusion of piece of the intestine through a weak umbilical scar.

3. **Femoral.**—Though hernia in the thigh (femoral) is fairly common in adult women, this form is extremely rare in children.

### Consequences of Accident.

It is very doubtful if an accident or injury ever causes an "acquired" hernia in a child. When a hernia makes its appearance for the first time soon after an accident, it is more than likely that the congenital tube, or sac, mentioned above was present previously, and that the accident had only been the cause of the hernia in so far as it may have driven a piece of intestine into this open sac, which up to that time had been unoccupied.

### Disease.

**Existing before the Accident and aggravating its Effects.**—When, however, a child that is suffering from rupture meets with an accident, he is exposed to greater danger than an adult, for the screaming or straining readily causes the hernia to be driven farther down, and to become strangulated or nipped where it protrudes from the abdomen. In a child there may be comparatively few symptoms to give an indication of the seriousness of the condition, and death is the almost inevitable result unless speedy steps are taken for its relief.

Many pre-existing conditions predispose to the occurrence of hernia. Chief among them are—Unobliterated processes or tubes of the peritoneum at the navel or groin, as mentioned above; weakness of the abdominal wall in wasting diseases or debility; increase of pressure inside the abdomen, such as arises from the following: tumours, fluid (in tuberculosis, peritonitis, etc.), straining in fits of passion or cough, especially whooping-cough. It is also common when there is a difficulty in passing water, due to a very tight foreskin, a stone in the bladder, constipation, worms in the bowel, etc.

### Operation.

Operation is by far the most satisfactory way nowadays of dealing with rupture in a child. It can hardly be looked upon as so necessary as in the case of an adult, for, especially in quite young children, there is a natural tendency to a spontaneous cure, and the wearing of a truss for a time may often be all that is necessary to bring this about, a condition which is not attained in an adult.

Should, however, strangulation occur, an operation is imperative. The operation is difficult on account of the small size of the structures and the delicacy of the bowel, but it is usually satisfactory.

### Cure.

After operation the time for cure is less than in the case of an adult, two or three weeks being, as a rule, the period after which the child may be allowed to get about again.

### Recurrence.

The risk of recurrence of the rupture is less in those cases that have been operated upon than in those who have been treated by a truss.

### Diagnosis.

1. **Inguinal Hernia.**—There are so many conditions that simulate an inguinal hernia in a child that it is unsafe to conclude that he is suffering from this from the mere fact that he has or has had a swelling in the groin.

An enlarged gland, a partially descended testicle, a collection of fluid in the unobliterated tube of peritoneum (hydrocele) (see Genital Organs—Male), or a pad of fat on the spermatic cord, may any of them be fairly easily mistaken for a rupture.

2. **Umbilical Hernia.**—A protrusion of fluid at the navel, tuberculous peritonitis, is not infrequently mistaken for a rupture. The presence of the disease in the abdomen should prevent the mistake being made, but if the evidence of the disease is not clear, and

Ruptures occur in children.

1. **In the Groin (Inguinal).**

acquired. The congenital SKIN.

discussed under Adult Hernia. Nature of accidents to the skin in descent of the contents of the

## THE SPINAL CORD.

There is no special feature about the spinal cord of children except some abnormality, which could not possibly be caused by an accident.

**Infantile Paralysis** is a disease of the spinal cord usually occurring in childhood. An account of it is given below, under Nerves.

## THE SPINE.

**Anatomy.**

The spine of a child differs somewhat from that of an adult. It is straighter, the antero-posterior curves (cervical, dorsal, and lumbar) of the adult being hardly recognizable in a young child. The whole spine, too, is more mobile owing to relatively greater looseness of the joints and laxity of ligaments. On the other hand, the bones which compose it are immature, and therefore more liable to injury by jars or falls on to the feet or into a sitting position.

The spine is sometimes the seat of congenital deformity (spina bifida), which is often associated with deformities of the feet and paralysis of the legs and bladder.

**Consequences of Accident.**

The spines of children are, of course, liable to all the serious accidents and injuries, such as fractures, dislocations, etc., that may occur in the case of adults; but particular interest attaches to slight injuries of this region in young children because of the possibility of spinal disease ensuing upon slight falls, blows, or jars.

**Disease.**

1. **Caused by the Accident.**—Just as in the case of bones and joints, of which, indeed, the spine is composed, an injury is sometimes followed by tuberculous disease, known as “spinal caries.” This disease is exceedingly common without accident, and affects generally the bones of the spine. It is one of the most serious diseases in children, for it produces deformity of the back. “Humpback” is usually caused by it, and should complications in the way of affecting the spinal cord occur, that may lead to paralysis of the legs, bladder, and rectum, and very possibly a fatal termination.

2. **Existing before the Accident and aggravating its Effects.**—As has been mentioned under Bones and Joints,

for a tuberculous disease to follow the infliction of an injury, the organisms of that disease must have been circulating in the blood previously, and the accident only have been the cause of determining the site of the development of the disease.

#### Operation.

After an injury to the spine itself, no operation as a rule is called for; but should spinal disease result, the operations that may have to be undertaken for the relief of its complications are many, and some of them serious, and may often have to be repeated.

#### Cure.

The treatment of spinal disease, even if no complications arise, is a long and tedious one, generally necessitating the keeping of the patient in a recumbent position for eighteen months to two years, or even longer. Should complications occur, this period may be prolonged very considerably.

#### Recurrence.

There is no tendency to recurrence except on the receipt of fresh injury.

#### SPLEEN.

There is nothing characteristic of the spleen in childhood.

#### STOMACH.

There is nothing special about the stomach in children.

#### THE TEETH.

1. Injury to the temporary teeth or to the permanent teeth, before they have erupted or cut through the gum, may cause deformity or irregularity in the permanent teeth.

At birth the germs of all the teeth, temporary and permanent, are present in the jaws, and while the temporary teeth are in existence the permanent ones are gradually developing underneath them. [Fig. 175.]

2. The temporary or milk teeth are ten in number in each jaw, and begin to make their appearance when the child is seven months old. The central incisors appear first, and, following in a fairly regular order, the most posterior molar appears

about the twenty-sixth month. The permanent teeth are sixteen in number in each jaw, and begin to appear at the sixth year, when the first (or most anterior) molar should appear. The others follow at fairly definite intervals until the second molar appears, about the twelfth year. The wisdom teeth, or most posterior molars, are not constant; in some people they are never developed. They may appear at any time from the fifteenth to the twenty-fourth year.

The temporary teeth are softer than the permanent ones, have much shorter roots, and are consequently much less firmly set in the bones. All the teeth have small arteries and nerves entering into them at the end of the root, on the integrity of which their life depends.

Comparatively few congenital defects are met with in the teeth, except in the case of cleft palate, when the cleft extends through the part of the jaw that carries the teeth. Under these circumstances the number of teeth may either be increased or diminished, and those close to the cleft sometimes cut through the gum very early; in fact, they may be visible at birth.

### Disease.

1. **Caused by the Accident.**—A serious blow may not only injure a temporary tooth, but may also affect the germ of the permanent tooth lying under it, and when this permanent tooth is cut it may be found to be misshapen, twisted, or misplaced.

If many temporary teeth be lost by accident or disease, the development and growth of the jaw is defective, so that when the permanent teeth appear there is not sufficient room for them, and they become irregular and crowded.

2. **Existing before the Accident and aggravating its Effects.**—Rickets, congenital syphilis, and infantile scurvy, all affect the gums and teeth, and produce irregularities of growth which might be mistaken for the consequences of an injury to the permanent teeth.

### Diagnosis.

Infantile scurvy causes bleeding of the gums, which must be distinguished from bleeding caused by accident. In this disease the child is very pale, and has also tenderness in the long bones of the arms and legs, owing to bleeding under the sheath of the bone (periosteum).

## THE TENDONS.

In a child it is difficult to find a divided tendon and to operate upon it without injury to other important parts in the neighbourhood, for both the tendon itself and the area to be operated upon are exceedingly small. There is the further difficulty in keeping a child's injured tendon at rest after the operation.

## THE THROAT AND TRACHEA.

## Consequences of Accident.

**Spasm of the Larynx.**—Children are particularly liable to swallow small foreign bodies, and they often suffer from spasm of the larynx, especially if they suffer from rickets. In consequence they are more likely to die of suffocation after the inhalation of some irritating substance, or through the impaction of a foreign body.

## Disease.

**Existing before the Accident and aggravating its Effects.**—Adenoids often render respiration through the nose difficult. These will, of course, accentuate the consequences of any accident to the mouth or throat.

## Operation.

Tracheotomy is often successfully performed upon children.

## THE THYMUS.

## Anatomy.

The thymus gland, which exists only in childhood, is situated behind the upper part of the breast-bone (sternum). It exercises some function upon the general nutrition of the body, but exactly what that function is is not known. It gradually wastes (atrophies), and disappears about the second year of life, but occasionally it persists until a later period. Its persistence or enlargement has been found in several cases where children have succumbed during or after the administration of chloroform, but what share its presence or abnormal size takes in bringing about this fatality, or in what way it does so, is not certainly known.

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*For legal cases concerning the Thymus, see CASE GUIDE: Thymus.*

## VESSELS.

## Head-note.

Injuries to the bloodvessels of children differ only from those of adults in that, as mentioned before, they stand loss of blood badly.

## Technical Terms.

*Hæmophilia*.—A disease in which there is a weakening of the natural processes tending to arrest bleeding, which in consequence occurs from a very slight injury.

*Nævus* or "*Birthmark*."—A congenital tumour in the skin composed of numerous bloodvessels.

*Căpūt Succēdānēūm*.—The bleeding under the skin of the scalp of an infant produced by prolonged pressure during labour.

## Consequences of Accident.

Bleeding from a wound inflicted at the site of a *nævus* may be excessive owing to the want of power of contraction of the vessels of these tumours.

## Disease.

1. **Caused by the Accident.**—Prolonged *anæmia* and debility may follow an excessive loss of blood. *Caput succedaneum* may take a long time, even as long as weeks, and even months, before its spontaneous disappearance.

2. **Existing before the Accident and aggravating its Effects.**—A child who has suffered from *hæmophilia* may easily bleed to death from a slight injury. This disease, as far as symptoms are concerned, is almost entirely confined to the male sex, and is hereditary through the mothers. Bleeding in this disease may occur in some internal part as the result of a blow.

## Operation.

All operations should be avoided in the case of *hæmophilia*.

## Cure.

A normal child's bloodvessels heal very rapidly after injury, and the repair in the surrounding parts is generally complete in a very short time.

## Recurrence.

In cases of *hæmophilia* a recurrence of the bleeding is to be expected after subsequent injury, but the tendency to this will not be dependent on, or due to, the first injury.

Diagnosis.

The diagnosis of hæmophilia can, as a whole, only be made from the history of the previous excessive bleedings after slight injuries, or from the history of the same affection in male relatives.

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*For legal cases of injuries to Children, see CASE GUIDE : Children.*

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**CHIMNEY SWEEP'S CANCER.**

*See* GENERATIVE ORGANS—MALE.

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**CHLOROFORM.**

RISK OF TAKING, ETC., *see* ANÆSTHETICS.

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**CHROME.**

ULCERATION, ETC., FROM CHROME, *see* POISONS, NOSE.

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**COCAINE.**

RISK OF USE, *see* ANÆSTHETICS.



# COLD.

By J. M. H. MACLEOD,

M.A., M.D., M.R.C.P.,

Physician for Diseases of the Skin, Charing Cross Hospital and Victoria Hospital for Children; Lecturer on Skin Diseases, London School of Tropical Medicine; and Co-Lecturer on Skin Diseases, Charing Cross Hospital Medical School; Editor of the *British Journal of Dermatology*.

## Head-note.

THE danger arising from cold is threefold:

1. Temporary loss of use of the part affected from disturbances of circulation.
2. Permanent loss of the part from gangrene.
3. Death from prolonged exposure to cold.

## Technical Terms.

(For many technical terms see Skin.)

*Dermatitis*.—Inflammation of the skin.

*Raynaud's Disease*.—A disease partially produced by cold, and of which cold is not infrequently the immediate cause of the attack; also known as "symmetrical gangrene."

It attacks the fingers, toes, nose, ears, etc., and produces at first a pale, numb, or "dead" condition of the affected part. This is followed by a livid congestion, and if the disease progresses it may end in mortification.

*Symmetrical Gangrene*.—See Raynaud's Disease.

## Anatomy.

The leading effect of cold on a tissue is to cause a contraction of the walls of the small arteries, which may go on till their channel is obliterated. Consequently the circulation of the blood to the part is cut off, and it becomes pale. If

warmth be applied a reaction takes place, the vessels relax, and blood rushes into them with such force and rapidity as to cause swelling and pain. If, on the other hand, the exposure to the cold be prolonged, the contraction of the vessels becomes complete, and the affected area becomes shrunken and dead.

### The Consequences of Exposure to Cold.

Cold may produce symptoms which, arranged in ascending order of severity, may be grouped into the following series :

- (i.) Pain in the finger-tips ("dead fingers") or in other exposed parts, leading to chilblains, or, in those who have a special susceptibility, to Raynaud's disease.
- (ii.) This progresses, and produces frost-bite or permanent cessation of circulation in the part. Unless reaction be re-established at this point, death of the part (gangrene) ensues.
- (iii.) Gradual affection of the entire body from cold, leading to death.

(i.) **Chilblains.**—The first effect of cold on a part is to cause a contraction of the small arteries which supply it with blood. This is followed by a paralysis and dilatation of the same arteries, and a congestion ensues. This congestion may persist, and be associated with itching and burning, especially when the part becomes warm. In this way are formed the reddish-purple raised hot patches known as "chilblains." In severe cases the walls of the bloodvessels suffer, and the fluid part of the blood escapes through them, forming blisters; or the skin may break, and a superficial ulceration of a most intractable type occurs. When ulceration heals scarring results.

Chilblains only occur in susceptible individuals who have a weak circulation, and in them they may be produced by comparatively slight degrees of cold. They appear in the parts where the circulation is naturally weakest, and which are most liable to exposure to cold—namely, in the fingers, toes, ears, nose, etc.

(ii.) **Frost-Bite.**—When the cold is very intense or exposure to it is prolonged, frost-bite of the exposed parts may take

place, the arteries are contracted, and the skin become blue, bloodless, and numb. This is followed by a sharp inflammatory reaction, the arteries dilate, and the blood runs into the part, distending it and causing great pain and swelling, and forming blebs on the skin. In severe cases the part becomes permanently frozen, and instead of this inflammatory reaction the arteries remain contracted, blood cannot enter, and mortification sets in. The part thus destroyed will eventually slough away (separate) from the healthy body unless removed by the surgeon.

(iii.) **Death from Cold.**—Exposure to extreme cold at first causes the blood to leave the skin and retract into the interior of the body. The man becomes drowsy and heavy. The mind becomes torpid and he feels drawn to follow his longing for a heavy, dull sleep. If he gives way, and be not disturbed, this passes into profound unconsciousness, and death supervenes.

Sudden death from cold has been known to occur. Two cases attributed to this cause were reported from Paris in October, 1908.

### Disease.

1. **Caused by Cold.**—*Skin Disease.*—A skin disease of red disfiguring patches, called “lupus erythematosus,” sometimes arises in a part affected by cold after the immediate effects of cold have passed away.

*Chilblains.*—See above.

*Raynaud's Disease (Symmetrical Gangrene).*—Cold is also partially responsible for this affection of the fingers, for it is met with not infrequently in cab-drivers and those who have to expose their hands in all weathers. This is a disease which was described by Dr. Raynaud with the title of “symmetrical gangrene of the extremities.” The causation of the affection is not fully understood.

2. **Existing before the Cold and aggravating its Effects.**—Various pre-existing diseases aggravate the effects of cold, and render individuals unusually susceptible to such affections as chilblains, Raynaud's disease, and lupus erythematosus.

Of these the most important are kidney disease (especially chronic Bright's disease), heart disease, malaria, tuberculosis, and diabetes. Such morbid states of the blood as are induced by alcoholism, lead-poisoning, etc., are also predisposing factors.

### Operation.

The only operation that could be required in frost-bite would be to cut away a part that was gangrenous. This would not be more serious on account of its being caused by cold than from any other cause; and as the part would probably be a finger, a toe, or part of an ear, the operation would be comparatively trivial and probably quite successful.

### Cure.

Chilblains are usually cured in about a week or so, but they may persist through the cold weather and recur each winter.

Raynaud's disease is difficult to cure, and the outlook for permanent recovery is not favourable.

Gangrene is incurable; the dead part must be removed by gradual natural separation or by operation.

### Return to Work.

Chilblains rarely prevent work, and only do so in severe cases where they are ulcerative, or where the occupation of the patient entails delicate manipulation, such as piano-playing or fine sewing.

Raynaud's disease may interfere with work in severe cases, as it may be impossible to cure it so long as the sufferer continues to expose the affected parts to cold.

### Recurrence.

**Chilblains.**—In susceptible individuals chilblains recur yearly with the advent of the cold season.

Raynaud's disease is also liable to recur.

### Occupation Diseases.

Any occupation which necessitates exposure to severe cold may be responsible for serious derangements of health, affecting chiefly such internal organs as the lungs, liver, and kidneys; but there is no occupation which especially produces these effects, except, perhaps, working in refrigerating chambers, where the workmen are liable to acute lung disease. Such occupations as cab-driving and the like sometimes lead to Raynaud's disease.

**Malingering.**

It is possible that malingering might be resorted to in the case of a finger or other part which had been mutilated or lost, where it was averred that frost-bite was the cause, whereas it was in reality due to some other cause, such as syphilis. There is no definite diagnostic sign, after the wound has healed, to indicate that a part, such as a finger-tip, had been lost from frost-bite.

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*For legal cases of injury by Cold, see CASE GUIDE: Cold.*

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**DOCTORS.**

FOR THE POSITION OF MEDICAL MEN, ETC., SEE EXPERT EVIDENCE  
AND THE NOTE AT THE END OF THAT ARTICLE ON P. 305.

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**DUODENUM.**

*See* INTESTINES, HEAT.

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**DURA MATER.**

*See* BRAIN.



FIG. 63.—HÆMATOMA AURIS: A TUMOUR COMPOSED OF BLOOD Poured OUT UNDER THE SKIN OF THE EXTERNAL EAR.

(From Rose and Carless's "Surgery.")

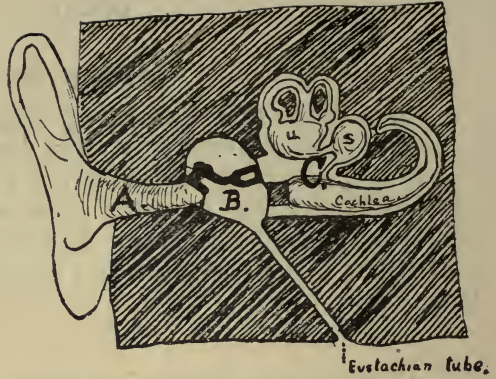


FIG. 64.—SCHEME OF THE HEARING APPARATUS IN MAN.

A, The external canal, ending at the drum; B, the middle ear containing the conducting bones, of which the stirrup-shape of the "stapes" is clearly seen; C, the inner ear, from the front of which runs the Eustachian tube; u, the semicircular canals.

(From Spurell's "Elementary Physiology.")

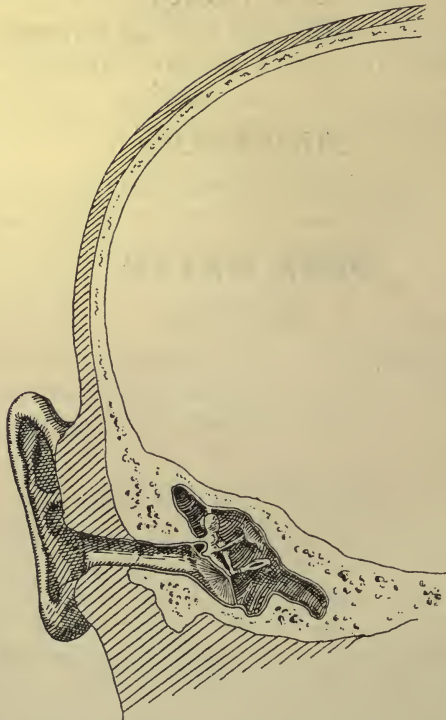


FIG. 65.—ACTUAL SECTION THROUGH THE RIGHT EAR OF MAN, SHOWING THE POSITION OF THE PARTS REPRESENTED DIAGRAMMATICALLY IN FIG. 64.

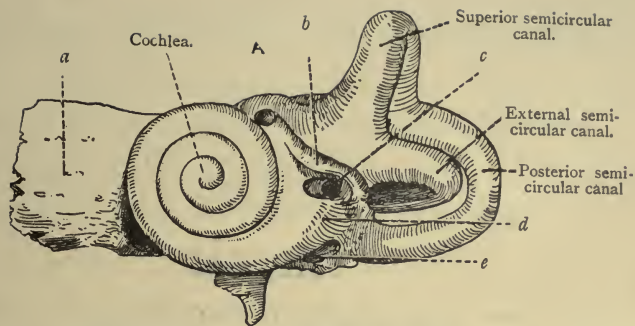


FIG. 66.—THE LABYRINTH OF THE LEFT INNER EAR IN MAN  
(MUCH ENLARGED).

The letters *a* to *d* refer to named parts.

(From Buchanan's "Anatomy.")

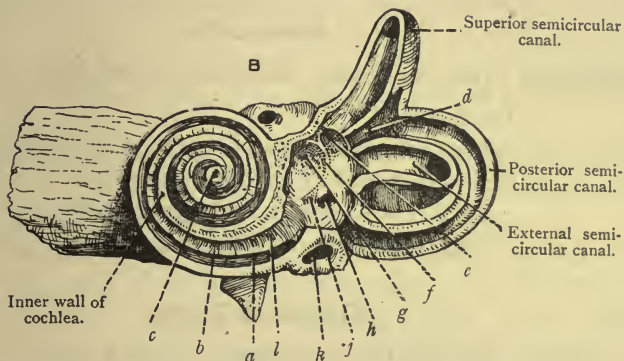


FIG. 67.—THE LABYRINTH OF THE LEFT INNER EAR OPENED.

The letters *a* to *h* refer to named parts.

(From Buchanan's "Anatomy.")



FIG. 68.—PROJECTION OF THE EUSTACHIAN TUBE, AS SEEN THROUGH THE  
HEAD FROM ABOVE. IT RUNS FROM THE EAR TO THE NOSE, INTO THE BACK  
OF WHICH IT OPENS.

# THE EAR.

BY HAROLD BARWELL,

M.B. (LOND.), F.R.C.S. (ENG.),

Surgeon for Diseases of the Throat and Nose, St. George's Hospital ;  
Surgeon in Charge of the Throat and Ear Department,  
Hampstead General Hospital.

## Head-note.

INJURIES to the ear lead to three serious results :

1. Deafness.
2. Intractable discharge of matter after inflammation.
3. Gradual spread of inflammation, which may increase until it is so severe as to cause death from inflammation or abscess of the brain.

## Technical Terms.

*Auditory Mēātūs.*—The outer canal. [Figs. 64, 65.]

*Cōchlea.*—Part of the internal ear concerned in the perception] of sound. [Figs. 64, 66, 67.]

*Eustāchian Tube.*—The air-canal leading from the throat to the ear. [Figs. 64, 68.]

*Hēmātōma.*—A blood-tumour formed under the skin. Common in the ear ; then called "hæmatoma auris." [Fig. 63.]

*Īncūs.*—"The anvil," one of three conducting bones between the drum skin and internal ear. The other two are the malleus and stapes. [Figs. 64, 65.]

*Lateral Sīnus.*—A large vein which drains the blood from the brain, and after leaving the skull becomes the deep or internal jugular vein. The lateral sinus lies in a deep groove on the inner surface of the skull just above the mastoid air-cells and behind the ear. [Figs. 52, 53, 54.]

*Mālleus.*—"The hammer." See above, Incus.

*Māstoid Process.*—A conical lump of bone situated just behind the ear. It contains an air-cavity communicating with that of the middle ear, and inflammation frequently spreads to it from the ear.



*Necrosis*.—Death of bone, leading to slow destruction or discharge of the piece of dead bone.

*Stâpēs*.—"The stirrup." See above, Incus.

*Semicircular Canals*.—A part of the inner ear concerned in the maintenance of equilibrium. [Figs. 66, 67.]

*Tÿmpânic Membrane*.—The drum-skin.

*Tÿmpânum*.—The middle ear, or drum. [Figs. 64, 65.]

### Anatomy.

The organ of hearing consists of the following essential parts which are arranged, as far as possible, in the order of their proximity to the outer ear :

The **outer ear** collects sound, but is of no further practical value for hearing.

The **external canal** runs from the outer ear down to the drum-skin. It is soft at the external commencement, but in the deeper parts passes through bone. It becomes considerably narrower in its passage inwards, but widens again as it approaches the drum. [Fig. 64.]

The **drum-skin** (or drum) is a thin tough membrane separating the outer from the middle ear; it serves the all-important purpose of receiving the vibrations of sound.

The **middle ear** (tympanum) is a cavity, containing air, on the inner side of the drum-skin, connected with the back of the throat by the Eustachian tube. This tube is so constructed that each act of swallowing opens it, and allows air to enter freely, thus maintaining the air in the middle ear at the same pressure as the atmosphere. [Figs. 64, 68.]

The middle ear contains three small bones—viz., the malleus (hammer), stapes (stirrup), and incus (anvil)—which are united by lever joints into a short chain attached at one end to the drum-skin, and at the other to the sound-perceiving nerves (*i.e.*, the "perceiving apparatus"). These small bones which we call the "conducting apparatus" increase the power of hearing by multiplying the vibrations of sound.

It is most important to keep quite clear the distinction between the "conducting apparatus" and the "perceiving apparatus," as disease of the former, which is very common, merely diminishes the power of hearing, whilst any serious injury to the latter must obviously result in completé deafness.

The **facial** or **7th nerve**, although no larger than a thread, controls almost all the movements of the face. It passes through the middle ear, but as it carries no nerve of sensation,

but only of motion, injury to this nerve, although it may result in facial paralysis, will still leave the power of feeling intact in the face. [Figs. 43, 44, 54.]

The **mastoid air-cells** are hollow spaces in the bones of the head which are supplied with air through communication with the middle ear. The most important is the mastoid antrum, lying inside a small pyramid of bone (the mastoid process) behind the ear. [Fig. 52.]

In inflammation of the middle ear, which often spreads to this bone, tenderness is frequently first felt over it. The lateral sinus, one of the great veins of the brain, lies in a deep groove, pierces the skull immediately in front of the mastoid air-cells (antrum), and then continues under the name of the internal jugular vein to the heart. [Figs. 52, 53, 54, 193.]

The mastoid antrum is thus of great importance, first on account of the facility with which it becomes inflamed, and, secondly, because its proximity to the lateral sinus involves the great risk of the inflammation spreading to and clotting the blood in this vein.

The **inner ear** contains the various complicated organs designated as the labyrinth, and constituting the "perceiving apparatus." It is here that the pitch of intensity of sound and the position of the body in space are heard or understood, the impression so received being conveyed by the auditory nerve to the auditory centre in the brain.

### Consequences of Accidents.

The following parts may be injured :

- (i.) The outside ear.
- (ii.) The external canal.
- (iii.) The drum.
- (iv.) The middle ear.
- (v.) The inner ear.
- (vi.) The nerve to the ear—auditory nerve.
- (vii.) The brain.
- (viii.) The facial nerve.
- (ix.) The lateral sinus.

(i.) **The Outside Ear.**—This may be cut or torn off; cuts or tears heal readily unless they become dirty and inflame. No serious damage except to personal appearance results from the ear being partially torn off. If the outer canal also is injured,

narrowing may result from constrictions of the scars when healing.

There are practically no after-consequences to be considered. Bruises produce a blood-tumour under the skin (*hæmatoma auris*), and this may form a lump on the edge of the ear. This will slowly absorb in part, leaving a thickened lump. It may become infected and form matter, which will be discharged, with some delay in healing. The surgeon may open the tumour and let out the blood or matter, after which operation healing will occur rapidly and leave no after-effects. [Fig. 63.]

(ii.) **The External Canal.**—This is commonly injured by the introduction of foreign bodies. Sharp bodies which are introduced by accident, or more usually intentionally to remove wax or relieve itching, if they do any harm at all, as a rule injure the drum. Smooth bodies may remain for years, causing merely slight deafness, giddiness, coughing, or headache; but in time they may start serious inflammation and destruction of the parts. Damage may be caused either by the carelessly attempted removal of a foreign body, or by its being fixed in the canal past its narrowest part. The subsequent trouble arises simply from one of two things: either the damage caused by inflammation which has occurred before the body was removed—and this may be very serious—or from the injury done in removing it. A foreign body wedged in the canal, setting up inflammation, may allow matter to collect behind it. This matter may rupture the drum, and so reach to the middle ear, where more matter is formed, until the whole ear may eventually be disorganized. This is, of course, a very rare result, as the pain would compel the man to call for medical help long before this stage was reached. The removal of a foreign body caught behind the narrow part of the canal may be an operation of some difficulty. (See below, Operation.)

(iii.) **The Drum-Skin (Rupture).**—Injury to this occurs most frequently under one of three conditions:

(a) The introduction or careless removal of foreign bodies.

(b) Air-pressure—*e.g.*, by violent blows on the outside ear; from explosions near the ear; or from sudden alterations of atmospheric pressure when the air-canal (the Eustachian tube) is partly or entirely blocked.

(c) Fracture of the bones supporting the organs of hearing.

This is common in fracture of base of the skull. If the drum-skin is healthy before the accident, a sudden crack is heard, and severe pain followed by giddiness, with or without loss of con-

sciousness. Bleeding is commonly profuse if the base of the skull be broken; but if the drum be merely ruptured there is, as a rule, an escape of a few drops only. Deafness does not necessarily occur. (See below, Deafness.)

To rupture a healthy drum by violence, the force must be very great; except that if the air be compressed against the drum-skin by a sudden impact from a blow from a soft object which completely fills the entrance to the canal, then, as the air cannot escape, comparatively slight violence will rupture the drum-skin.

In any case a diseased drum-skin is more likely to be ruptured from slight blows.

The consequences of an injury to the drum-skin depend simply on whether or not the wound has become infected with micro-organisms forming pus or matter. Under the most favourable circumstances the simple puncture or rupture of the drum-skin heals rapidly, and leaves no symptoms after. (See below, Deafness.)

If matter forms, the future is uncertain. In one week the whole of the trouble may be over, or years afterwards an insidious spreading of the micro-organisms, causing inflammation, may end in abscess of the brain.

The small bones of the middle ear may be discharged, a hole being left in the drum-skin which will not heal, or almost the whole of the drum-skin may be destroyed by the matter eating it away. This spread may not only destroy the facial nerve, but even affect the big veins of the neck, giving rise to the most serious symptoms. (See below, Injury to the Veins near the Ear.)

(iv.) **The Middle Ear.**—As has already been mentioned, disease of the middle ear is usually a secondary consequence of injury to the drum-skin and secondary spread of inflammation.

Fractures of the base of the skull very commonly break the bone round the middle ear and drum. Bleeding from the ear occurs in consequence, but the important symptoms of fracture of base of skull are really those of injury to the brain. (See Brain, p. 117.)

Where inflammation once sets up and matter collects in the ear, no one can predict its end. Operations to clear out the unhealthy lining may have to be repeated again and again. The matter may spread slowly into the deeper parts, first into the mastoid air-cells (see above), and then farther, causing inflammation of the inner ear, nerves, veins, and covering of

the brain, and, at last, even abscess of the brain. (See below, Disease, Operation, and Cure.)

A chronic discharge which may be slight or profuse is the usual symptom of middle-ear disease. Middle-ear discharge arises more commonly from disease, and without an accident, than with one. (See Diagnosis.)

(v.) **The Inner Ear.**—The inner ear is, like the middle ear, usually injured by disease spreading from elsewhere in the body rather than by accident.

Permanent deafness from disease of the middle and inner ear produces different results. (See below, Deafness.) Another common cause of deafness arising in the inner ear is concussion, the result of a severe blow or shock. (For results of this see below, Deafness and Cure.)

(vi., vii.) **The Auditory Nerves and Brain.**—Injury to these is common in severe injuries to the base of the brain, and the symptoms will be those of injuries to the rest of the brain. (See Brain.)

(viii.) **The Facial Nerve.**—Injury to the part passing through the ear is rarely the result of an accident, except in cases of fracture of the base of the skull, but it is affected by inflammation of the middle ear. The symptoms of implication of the facial nerves are, paralysis of all the muscles supplied by it, which are the majority of those of the same side of the face. As it conveys no nerves of sensation, inflammation of this nerve alone occasions no pain or numbness. (For the after-effects see below, Disease.)

(ix.) **Injury to the Veins near the Ear.**—Though hardly ever as the direct result of injury, these veins are at times infected by an inflammation spreading from the ear. The consequences are most serious. The blood may clot, or matter form in the veins, which may spread all over the body, causing the deadly disease of pyæmia. (See Infection—Pyæmia, p. 448.)

### Disease.

**I. Caused by the Accident.**—(a) *In the Parts near or implicated by the Accident.*—The infection of the parts by micro-organisms and the consequent formation of matter lead to the spreading of infection from the surface to the deeper parts. The result may be exposure and death of some portion of the bone forming part of the organ of hearing. This condition is exceedingly slow in recovery, as the dead bone has to be either ex-

pelled by the slow process of separation from the sound parts, or destroyed by an almost equally lengthy process of decay.

The infection of organisms, through spreading within the boundary of the organ of hearing, may in its course through the middle ear reach the facial nerve; or the big veins, particularly the lateral sinus (lying as it does on the inside of the skull near the ear), may be infected and a clot or matter form. The mastoid bone is usually one of the earliest of the neighbouring parts to be infected by micro-organisms, the spread of which in this confined space constitutes a grave danger of pyæmia. (See Infection—Pyæmia, p. 448.) The inner surface of the skull bones may also become inflamed, and the inflammation spread to the brain or its coverings.

(b) *Accident to other Parts leading to Disease of the Ear—Nose, Throat, or Air-spaces (Sinuses).*—Injury and subsequent formation of matter in the nose or air-spaces communicating with it may lead to infection of the Eustachian tube, and the consequent spreading of disease along it to the ear.

A more common result of accident to the nose is simple catarrh of the Eustachian tube, the blocking of which leads to absorption of the air on the inside of the drum, and the consequent stretching and depression of the drum itself, causing deafness and rendering it more liable to burst.

Injury to the nose or throat thus leads to acute or chronic catarrh of the ear, which may produce deafness, noises in the ear, or spread of inflammation as described above.

**2. Existing before the Accident and aggravating its Effects.**—The drum may be thinner, and consequently weaker, in certain spots, a condition which is due to catarrh, old scars, existing inflammation, or to inflammation or blocking of the Eustachian tube. Thus weakened, the drum may be burst by a comparatively slight degree of violence.

Old inflammation of the middle ear greatly increases the risk of trouble after slight injury.

The occupation of a diver or caisson worker should never be undertaken by anyone who has so suffered. (See Caisson Disease, p. 202.)

Old uncured ear trouble is very easily aggravated into activity by a fresh accident.

Matter in a quiescent condition in the ear seldom gives rise to any symptoms, but a trivial injury may stir up the inflammation to great activity, with serious, and even fatal, consequences.

### Operation.

(i.) **The External Ear.**—Tears or cuts in the outside ear require a small stitch. The blood-tumour should be opened and the blood let out, after which the ears should get well immediately. These are trivial operations.

(ii.) **The External Canal.**—The simple operation of removal of a foreign body with a pair of forceps is quite easy. To remove part of the canal in order to extract an impacted body, or to extract one in the midst of inflammation, is an operation requiring chloroform and demanding great care. It is absolutely necessary to operate in some cases, as the matter blocked behind the foreign body, if it cannot get out, will spread inward and cause immense damage. (See above, Disease.)

(iii.) **The Drum.**—Where the drum is naturally intact or has healed after an accident, and matter is collected behind it, this must be let out.

After the application of cocaine or under gas, a small cut is made in the drum, and the matter escapes. This is quite a small operation in skilled hands, and the ear will soon heal when the discharge ceases.

(iv.) **The Middle Ear.**—If, from infection arising through a ruptured drum or from any other cause, matter once starts to spread from the middle ear, an operation will probably be necessary.

The simplest and most frequent operation is the opening of the air-cells in the mastoid bone behind the ear.

When the ear is inflamed, these cells often become filled with matter, and in many cases it is sufficient to open this bone to cure the disease. If no more is required, the risk of the operation is small, and the hearing power of the ear is intact, or, if impaired, not altogether destroyed, as the inner ear with its mechanism for perceiving sounds will remain.

But more may be required, when the severity of the operation will vary from the comparatively slight matter of merely opening this mastoid bone, to the most extensive operations on the inner ear, and even the brain.

These operations may be absolutely necessary to prevent the matter spreading inwards to the brain, a result which has frequently caused death.

(v.) **The Inner Ear.**—If, after injury, the inflammation spread to the labyrinth of the internal ear, it will be necessary to open

this by operation. The danger is considerably increased, and the hearing in that ear is destroyed.

(vi.) **The Nerves to the Ear.**—No operation is required.

(vii.) **The Brain.**—Abscess of the brain is a not uncommon result of inflammation in the ear. It is essential, in order to save life, to open the abscess and give exit to the matter. These operations are always severe, but the risks vary in individual cases.

Bleeding into the brain may occur as a result of the injury to the ear, and it may be necessary to expose and remove the blood-clot.

(viii.) **The Facial Nerve.**—If the facial nerve be injured in its passage through the bone of the ear, no operation to restore it offers any certain prospect of success.

(ix.) **The Lateral Sinus.**—Inflammation of this vein occurs by extension from the ear. In order to prevent death from blood-poisoning, it is then necessary to open it, and often also to open the large vein (jugular) in the neck. This condition is most serious.

#### Cure.

(i.) **The External Ear.**—The cuts heal in a few days, but the curing of the hæmatoma (blood-tumour) is uncertain, and dependent upon circumstances. If opened early and the blood be allowed to escape, the whole thing will be over in a week. If inflammation has set up, the time will be indefinite, and be dependent solely on the subsidence of the inflammation. If simple absorption takes place, the final traces of the swelling will remain permanently.

(ii.) **The External Canal.**—Simple removal of foreign bodies is coincident with cure, but if there be inflammation, no time can be stated for its termination.

(iii.) **The Drum.**—Should infection be present, the healing of a ruptured drum is probably a long process, but otherwise it will quickly be well. A clean wound heals, and is well in a week; whilst an unhealthy one may never be cured. (See above, Disease of the Middle Ear.)

(iv.) **The Middle Ear.**—This will heal in time, the length of which is dependent upon the inflammation. When it is infected the time for cure is indefinite. Where there is no infection it may heal rapidly.

(v.) **The Inner Ear (Injuries from Concussion).**—If not cured in three weeks, this condition will probably not improve. It is one of the most incurable of ear troubles.



(vi.) **The Nerves**; (vii.) **the Brain**; (ix.) **the Lateral Sinus**.—It is impossible to give any period for cure in the cases in which these parts are involved. The results are serious, and frequently fatal.

(viii.) **The Facial Nerve**.—This nerve may be involved in a slight inflammation as the result of injury, in which case it may recover in a few days. Much more often, however, it is permanently damaged.

### Return to Work.

(i.) **The External Ear**.—In ordinary cases, as soon as the surgeon has dealt with the injury the man can return to work. Some special reason connected with personal appearance might prevent a man from following his occupation, but one to two weeks should be sufficient to cure any injury happening to the external ear if properly treated by a competent medical man.

(ii.) **The Outer Canal**.—This depends upon cure, for when cured the man may return to work. (See above.)

(iii.) **The Drum**.—This depends to some extent on the cure. But if the work is likely to cause a repetition of the accident, it is running a risk of a fresh rupture for the man to return to the same work. (See below, Nerves of the Ear and Deafness.)

(v.) **The Inner Ear**.—See above, Cure.

(vi.) **The Nerves of the Ear**.—After injury to the drum, middle or inner ear, uncomplicated by other injuries, it is ordinarily possible to return to work as soon as the shock of the accident has subsided. Deafness of one ear or a discharge does not suffice to incapacitate a man from following most occupations. Severe inflammation following incapacitates from work.

(vii.) **The Brain**; (viii.) **The Facial Nerve**; (ix.) **Lateral Sinus**.—When the brain or large veins are affected by inflammation, spreading from the ear after injury, the patient is completely incapacitated; the incapacity may be permanent, or at least last for many months.

**Deafness**.—The time for cure of this varies with the source of the deafness. Injury to the drum may neither cause marked deafness nor, where it has occurred, may it leave any permanent deafness. (See below, Deafness.)

In some employments deafness is no hindrance; in others it means permanent loss of occupation.

**Discharge from the Ear**.—All discharges of matter from the

body are to some extent a source of danger to others. If the neighbours be healthy and well, and the discharge not offensive, the risk is trivial; but if the discharge is from the ear of a nurse or doctor who has to attend confinements or perform operations on the interior of the body, then it should preclude them attending to their duties.

### Recurrence.

When once cured, injury to the outer ear or outer canal shows no tendency to recur.

A drum once ruptured will not burst again spontaneously, although it will remain a weak spot for the rest of the man's life. The scar may be ruptured again by far less violence than would burst a healthy drum. Inflammation in the ear is at times most difficult to cure; there is no possibility of naming a time when it will be cured. When an apparent recurrence occurs it is in most cases simply a recrudescence. Often when the discharge has stopped, a very slight blow over the ear may cause it to start again.

### Occupation Diseases.

The gradual onset of deafness caused by continuing noise is a marked feature of certain occupations. The cause is usually progressive inflammation of the internal ear, and it is common in riveters, boiler-makers, artillerymen, etc.

Sudden explosions may occur in the course of certain occupations—*e.g.*, quarrymen and gunners—causing rupture of the drum.

Those who are exposed to inclement weather are liable to catarrhal conditions of the ears—*e.g.*, sailors, engine-drivers, carmen, cabmen.

Irrespective of the general symptoms of compressed air disease (see Caisson Disease), the middle or inner ear may be injured directly by changes of atmospheric pressure in caisson workers and divers. If the changes of pressure are made with proper slowness, injury can only occur when the air-tube from the nose to the ear (the Eustachian tube) is blocked, for if the tube be open to the air, both sides of the drum are equally affected by the changes of pressure. When, however, the tube is blocked, the unequal pressure will cause severe deafness, giddiness, and noises in the ear. Thus, persons with chronic ear disease or with catarrh of the nose should never be allowed to enter a caisson.

Lead, mercury, phosphorus, arsenic, bisulphide of carbon, and the aniline dyes, may all produce deafness from catarrh of the middle ear or from poisoning of the nerves in those who work in these substances.

### Diagnosis.

**Rupture of the Drum.**—It is of extreme importance to the master and possible defendant that a very early examination of the drum said to be ruptured by the accident should be made by a competent ear doctor.

The drum is far more commonly perforated by disease than by accident; but although the signs of recent accident are fairly clear, those of disease and old accident are almost indistinguishable.

The recent rupture is usually a clean linear cut, radiating from the centre to the edge of the drum; but if the tear be through an old scar or a weak patch it may be of any shape. The edges appear bruised, or are covered with dried crusts of blood; the rest of the drum is not inflamed, and there is no formation of matter. Healing takes place in a very few days unless the wound inflames, and then the hole soon becomes round or oval. On the other hand, in recent cases of perforation caused by disease there is much matter present; the whole drum and middle ear, and often the outer canal, are inflamed. In cases of old quiescent disease the edges of the perforation are thickened by scar tissue, and are often adherent to the inner wall of the ear.

**Tests for Deafness.** (See below, Malingerer.)—The importance is to distinguish the locality of the trouble.

Disease of the sound-conducting apparatus—drum and small bones—shows results to tests quite different from disease of the sound-perceiving apparatus (*i.e.*, the cochlea and semicircular canals, and nerves and brain beyond).

The basis of the test is the presence or absence of the conducting apparatus on the one hand, and of the perceiving apparatus on the other.

Sound is normally heard, intensified, and conducted, by the drum and small bones of the middle ear. If all of these are injured, and yet the perceiving apparatus is left sound, vibrations can still reach it and a sensation of hearing is still felt, for the bones of the skull, independently of the conducting bones of the middle ear, can still convey sound. In fact, this latter

perception through the bones of the skull is increased when the conducting apparatus is affected. A tuning-fork is normally heard longer when held opposite the outer canal of the ear than when its base is applied to the bone behind the ear, and this relationship is unaltered in deafness due to defects of the sound-perceiving apparatus (nerve deafness). But in cases of damage to the conducting apparatus—*i.e.*, to the drum and small bones of the ear (middle-ear deafness)—if the base of the tuning-fork be placed against the skull, it will be heard as before, but it will be heard longer than when the fork is held opposite the external ear; for where the conducting bones are destroyed, and in consequence the intensifying action they produce is lost, the sounds which enter through the external ear are not well heard, while the conduction of sound direct through the bones of the skull is increased. In nerve deafness the high notes, and in middle-ear deafness the low notes, are especially badly heard.

### The Malingerer.

1. **The Ruptured Drum.**—Discharge from the ear is a common disease in childhood, or may occur as a disease at any later date. It may make a hole in the drum, which the patient may claim to be due to the accident. The only way to be certain is to have the ear examined immediately after the injury (see above, Diagnosis—Ruptured Drum), and to search for a history or for signs of its old date.

2. **Deafness.**—This is simulated in three forms :

- (i.) Complete deafness in both ears.
- (ii.) Complete deafness in one ear.
- (iii.) Partial deafness.

The form usually simulated is “nerve deafness,” as the malingerer is certain to show diminished perception through the bones of the skull. (See above, Diagnosis—Tests for Deafness.)

(i.) *Complete Deafness in Both Ears.*—The violence necessary to destroy the hearing in both ears would have to be very great, though an explosion might produce the result; the malingerer should be detected without much difficulty without formal tests. A sudden sound behind his back, shouting when he is sleeping, and calling him by name, will usually result in discovery, but the noise must not be too great, or the man may justly say he “felt a shock.”

(ii.) *Complete Deafness in One Ear.*—This is a very common form of malingering. Usually, if the affected ear be turned towards the examiner, the malingerer will forget that he can still hear to some degree with the other ear. A large tuning-fork put on the mastoid bone, behind the ear, will, of course, to some extent be heard by the healthy ear of a truly deaf man, but the malingerer is entirely deaf to it. A good method is to speak into the bell of a binaural stethoscope, of which one tube has been blocked (and carefully tested to prove its non-conduction). The tubes are placed in the patient's ears, and repeatedly changed, when the malingerer will soon be caught.

Two telephones, one attached to each ear, will usually detect a malingerer; if two examiners rapidly ask questions of a different kind he will soon fail, and answer the wrong man, and show that he hears with his "deaf" ear.

(iii.) *Partial Deafness.*—The eyes must be covered, and repeated tests made at different distances with various sounds and tones; it is very rare that a malingerer can give consistent answers under such circumstances. If the man gives, as is usual, the signs of diminished bone conduction, indicating nerve deafness, and yet hears the highest notes of the scale as well as he hears the lowest, grave suspicion should be aroused.

In all these cases a very careful written record must be made at the time, so that the exact result of the tests may be explained in court. A still more valuable demonstration of the malingering attitude of the man will be made if the tests are repeated in open court. This has been done with great success in the case of eye tests.

### Deafness.

This must be made the subject of a separate section, for it arises under various circumstances, and its importance depends on its curability, which varies with the different parts of the ear affected. The important point is, to distinguish between injury to the conducting and perceiving apparatus; for the former is a form of deafness which is curable in some cases, while, on the other hand, injury to the nerves and internal ear when once established is nearly always incurable.

(i.) **Foreign Bodies in the Ear.**—These cause a dulling of hearing rather than an absolute deafness, unless complications arise afterwards.

(ii.) **Injury to the Drum.**—An uncomplicated rupture of the drum at first causes slight deafness, which passes off when the

drum is healed ; but if the wound in the drum becomes inflamed, deafness frequently results, and this varies from a very slight degree to an almost complete loss of hearing. This deafness depends on the spread of inflammation to the middle ear, for even when a permanent hole is left in the drum a considerable power of hearing remains, provided that the middle ear is not much damaged.

(iii.) **Injury to the Middle Ear, or Conducting Apparatus.**—Damage to the middle ear, causing deafness, may result from direct injury to the part, as in fracture of the base of the skull, or from spread of inflammation after injuries to the drum, throat, or nose, in which case the inflammation spreads along the air-pipe to the ear from the nose (the Eustachian tube). Many of these cases yield readily to treatment.

(iv.) **Injury to the Inner Ear, or Perceiving Apparatus** (“**Nerve Deafness**”).—Any injury to the brain or to the nerves from it, or to their highly specialized nerve-endings in the cochlea and semicircular canals, usually involves permanent deafness. It is frequently impossible to determine which part of the system is affected, for cases of accident or disease to any of these parts give the same tests for hearing. It may be caused by simple concussion, as by a blow, an explosion in the neighbourhood, or merely a loud noise which so shakes up some of the parts that they never recover, or by any degree of inflammation, from simple thickening to a complete destruction by formation of matter.

In fractures of the base of the skull, the patient, if he recovers, is frequently permanently injured in one of these parts. Deafness resulting from concussion which has injured the inner ear, only, is accompanied by no alteration in the appearance of the ear or drum.

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*For legal cases of injuries to the Ear, see CASE GUIDE : Ear.*

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## ECZEMA, ECZEMATOUS ULCERATION.

*See SKIN.*

# ELECTRICAL INJURIES.

By C. M. HINDS HOWELL,

M.D. (OXON.), M.R.C.P.,

Physician to the Great Northern Central Hospital; and Registrar, with charge of Electrical Department, of the National Hospital for the Paralyzed and Epileptic.

## Head-note.

THERE are three main sources of electrical accidents :

1. Contact with electrical currents (industrial).
2. X rays. (See X Rays.)
3. Lightning.

The principal results of these accidents are of two kinds :

1. Local : Burns, inflammation, and, indirectly, cancer.
2. General :
  - (i.) Death.
  - (ii.) Paralysis, which may be either (a) organic (*i.e.*, due to some gross damage to the nervous system) or (b) functional (*i.e.*, unaccompanied by such gross damage).
  - (iii.) Psychological disturbances, such as fits, neurasthenia, melancholia, depression, etc.

## Technical Terms.

*Accumulator*.—A battery for storage of electricity. It is usually charged from the main, and when charged will give out electricity as required until exhausted, when it has to be charged again.

*Ampère*.—The standard unit or degree for measuring the quantity of electricity flowing along an electric wire. It may be compared to the number of gallons of water flowing through a pipe when a gallon is the unit of measurement of fluid. In other words, an ampère is the unit of current.

*Ânōde, or Positive Pole*.—The pole from which an electric current flows—*i.e.*, the place where the electric current enters a conductor along which it flows.

*Battery.*—(a) Primary, a cell or series of cells for generating a constant current of electricity; (b) secondary, which does not generate currents, but stores the current developed elsewhere.

*Circuit.*—The path along which electricity flows. There must be no break in this path, or electricity cannot flow along it. For instance, if a piece be cut out of a wire along which a current is flowing, there will be no further flow until the two cut ends are joined again.

*Conductor.*—Any material along which electricity can flow. Metals and metallic substances are good conductors. Glass, wood, india-rubber, etc., are bad conductors, or non-conductors. Non-conductors are also called “insulators.” (See Insulator.)

*Current.*—The quantity of electricity flowing along a conductor at a given moment. This is measured in amperes. There are different forms of electric current—*i.e.*, constant, where the flow is always in one direction; alternating, where the flow is first in one direction and then in another. In addition to this, other forms of current exist, such as “induced,” “interrupted,” and “high frequency.” “Sinusoidal” and “three-phase currents” are varieties of alternating currents.

*Dynamo.*—A machine for producing an electric current. Such are used in the generating stations of electric light mains.

*Electrode.*—A special end of a conductor, by means of which a current is applied for example to the human body.

*Electromotive Force.*—The inherent energy or pressure which causes electricity to flow from one point to another in a circuit. It is measured in standard degrees called “volts.” It may be compared to the pressure of water in the water-pipes from a tank.

*Faradic Current.*—An alternating, induced, and interrupted current.

*Fuse.*—A piece of wire, usually an alloy of tin which melts at a low temperature, introduced into an electric circuit, allowing only a certain quantity of electric current to pass at a time. If more electricity attempts to pass, the wire becomes red-hot, and, melting (*i.e.*, “blowing” or “fusing”), breaks the continuity of the circuit and stops the current.

*Galvanic Current.*—A constant current.

*Galvanometer.*—An instrument for indicating when a current of electricity is flowing, and for measuring its strength.

*High Frequency Current.*—A current produced by an immense number of oscillatory discharges (high frequency) per second. Such are obtained by the discharge of Leyden jars.

*Induction Coil.*—A mechanism consisting of two separate coils of insulated wire called the primary and secondary coil, so arranged for the purpose of producing an induced current. An automatic device (*e.g.*, a vibrating spring) is introduced into the primary circuit, by which the current flowing along the circuit is interrupted at frequent



but regular intervals. At the make and break of the primary current an alternating, induced current is produced in the secondary coil.

*Insulator.*—An insulator or non-conductor is a substance along which a current of electricity cannot flow — for example, glass, wood, and vulcanite. (See Conductor.)

*Käthode, or Negative Pole.* — The pole towards which a current flows, and the place at which it leaves a conductor through which it has passed.

*Live Wire.*—An uninsulated wire carrying a current ; it may have been insulated originally and the coverings destroyed by time, etc. It is dangerous if it carry a big current, because it allows the escape of the electric current.

*Milliampère.*—The one-thousandth part of an ampère.

*Negative Pole.*—See Kathode.

*Non-Conductor.*—See Insulator.

*Ohm.*—This is the unit of resistance. The Paris Congress of Electricians in 1884 defined a unit of resistance — *i.e.*, a “legal ohm” — as being the resistance to the flow of a current offered by a column of pure mercury at 0° C., of a uniform cross-section of 1 square millimetre, 106 centimetres long, and weighing 14.4521 grammes. It is slightly less than the ohm. (See Ohm’s Law.)

*Ohm’s Law.*—This is a law by which the quantity of current flowing in a circuit may be calculated. It states that the current in ampères (C) varies directly as the electromotive force (E), and inversely as the resistance (R) in any circuit or part of a circuit.

Where E is measured in volts and R in ohms, the formula is  $C = \frac{E}{R}$ .

So a current of 1 ampère is produced by passing 1 volt through 1 ohm of resistance and  $\frac{1}{2}$  ampère through 2 ohms of resistance. By this method the standard “volt” is obtained.

*Positive Pole.*—See Anode.

*Short Circuit.*—An alternative path for a current of electricity of less resistance than that along which the current was originally flowing.

*Tētānic Contraction.*—See Tonic Contraction.

*Tonic Contraction.*—Continuous, violent, and prolonged contraction of a voluntary muscle (tetanic contraction).

*Volt.*—The unit of electromotive force.

*Voltage.*—Voltage is the power, electromotive force, or pressure, at which a current of electricity is flowing along a wire. The limit of voltage at which electricity may be supplied to houses under the Board of Trade regulations is 252 volts. (See Ohm and Ohm’s Law.)

*Voltmeter.*—Instrument for measuring the voltage of a current of electricity.

### Nature and Physics of Electricity.

(i.) Electricity. What is electricity?

(a) Electricity at rest : static electricity.

(b) Electricity in motion : dynamic electricity.

(ii.) Conduction of electricity.

(a) Conductors and non-conductors, or insulators.

(b) Resistance to the flow of current—Ohm's Law.

(i.) **Electricity.**—It is, unfortunately, impossible to define exactly what electricity is; we can only judge of it by its results.

Now, although electricity may manifest itself under different conditions, it is important to understand that all electricity is essentially the same. Therefore, in speaking of static electricity, constant or alternating currents, and so on, one must remember that these are not different kinds of electricity, but the same electricity appearing in various guises.

(a) *Static Electricity.*—Static electricity can be produced by friction or by induction. If, for instance, a glass rod is rubbed with a piece of silk, the glass rod will be found to be charged with electricity, as evidenced by its power to attract small pieces of paper. What has happened is that the electricity, which was present in the glass rod in a kind of inert condition, has been rendered active by separation into two component parts, called "positive" and "negative" electricity, which have exactly the same properties. The glass gets a positive, the silk a negative charge. The pressure, potential, or "voltage," as it is called, of the positive charge on the glass is, of course, very small; but imagine it many times greater, and then bring the charged glass rod up towards another body, and a spark will then appear between them. This spark occurs when the electrical pressure or tension, or mutual attraction of the positive and negative, is sufficient to discharge the electricity on the glass rod to another object, and drive it through the resistance which the intervening air opposes to its passage.

This is what happens on a gigantic scale in Nature when flashes of lightning occur. Fortunately, in this country, as a rule, the discharges are between one cloud and another; but this is not always the case, and discharges between one cloud and earth sometimes take place. The potential, or voltage, or pressure, of electricity on the earth is always regarded as zero,

whilst the voltage or pressure causing a flash of lightning has been estimated as approximately 3,000,000 volts.

(b) *Electricity in Motion (Dynamic Electricity)*.—Here we have either continuous or alternating currents to deal with. These may be produced for physical, medicinal, and physiological purposes by means of batteries and the induction coil; but for industrial purposes, where an enormous pressure is required, these will not suffice, and a dynamo must be used.

(ii.) **Conduction of Electricity**.—(a) *Conductors and Insulators*.—A current of electricity, whether continuous or alternating, requires a path along which it can flow. Such a path may be provided by a variety of different objects. Those which are most suitable—*i.e.*, conduct best—are called “conductors,” and those materials which are unsuitable—*i.e.*, offer great resistance to the flow of current—are spoken of as “non-conductors” or as “insulators.” There is no perfect conductor; such a material would have to offer no resistance whatever to the passage of an electric current. The metals, however, offer the least resistance, and are therefore most widely used as conducting agents. Now, the resistance to the flow of a current depends not only on the material of which the conductor is composed—whether metal, stone, etc.—but it also depends on the length and on the cross-section of the material. A copper wire 1 foot long and  $\frac{1}{8}$  inch in diameter will offer more resistance than a copper wire only 6 inches long and 1 inch in diameter. Insulators are, as we have stated, materials which offer a large resistance to the passage of an electric current. Such are glass, indiarubber, silk, the skin of the body, especially where it is thick and hard, as on the palms of the hands and the soles of the feet. No perfect insulator exists any more than a perfect conductor.

The terms are relative: all materials will under certain circumstances allow a small current of electricity to pass. Wetting any non-conductor—for instance, the human skin—reduces its resistance very much, and hence allows it to conduct electricity much better than if dry. It is important to remember this, especially in connection with human skin, clothes, boots, etc. Why one lays so much stress on this question of conductors and insulators is that they are one of the factors which determine how much current of electricity can pass. Other things being equal, more “current” of electricity will flow along a path which has a low resistance—*i.e.*, is a good conductor—than along one which has a high resistance. The other factor which determines the amount of electricity which flows is the pressure of

the electricity, the number of volts, or the force tending to drive it along against the resistance in its path. More current will flow the more this driving force is increased.

Electricity in some ways can be compared to water, which flows always from a point where the pressure is high to another where it is lower, and under the same pressure more water will flow along a wide pipe—*i.e.*, when the resistance is low—than along a narrow one which offers more resistance. So, given the same voltage, more electricity will flow along a good conductor than along a bad one.

(b) *Electrical Resistance.*—We are now in a position to define what is meant by a “current” of electricity.

*Ohm's Law.*—A current of electricity is the quantity of electricity which flows along a conductor at any given moment. It is important to realize that it is a “quantity,” and nothing else. The quantity is measured in “ampères,” which are the units of current. Now, the current is evidently the outcome of two opposing forces, which are, first, the pressure, or electromotive force (voltage, as it is called), and, secondly, the resistance. These are measured respectively in volts and ohms. A law has been formulated, and is known as “Ohm's Law,” which expresses the relation of these various factors to each other. It is as follows: The current in ampères in any conductor or part of a conductor varies directly as the electromotive force (measured in volts), and indirectly as the resistance (measured in ohms), or  $C = \frac{E}{R}$ , where C is current in ampères, E electromotive force in volts, and R resistance in ohms.

In order to ascertain what is the resistance of a conductor in ohms, we measure the current produced by a known voltage after it has passed through the unknown resistance. Take, for instance, two currents, one at 1 volt (E), the other at 500 volts (E) pressure, and, after they have been passed through two unknown resistances, the current in each case is found to measure 1 ampère (C). It is clear that the current at 500 volts met a resistance of 500 ohms (R), and that the current at 1 volt met a resistance of only 1 ohm.  $C = \frac{E}{R}$ , and in each case  $C = 1$ ;

therefore  $1 = \frac{1}{R}$ , and so  $R = 1$ , and  $1 = \frac{500}{R}$ , therefore  $R = 500$ .

We shall see, when considering electric shocks, that the current (ampères) which enters the wire or conductor is not the most essential factor to consider. What is essential is the

electromotive force, or voltage, at which the current is supplied, because this will determine the amount of current (ampères) which will flow into and through the body.

Ohm's Law is a very important one to remember, and its application is of much value when considering claims for alleged injuries. For example, a man may state that he has received a severe electric shock, and the electromotive force on the circuit from which the shock was obtained will be known. The man's resistance is known within limits, or can be estimated fairly accurately. Consequently the amount of current which passed through him can be easily calculated, and from its amount an idea formed as to the probability of such a current having produced the alleged injuries.

For further details on the physics of electricity the textbooks must be consulted.

### Industrial Electricity.

The following is a short account of the conditions met with in industrial electricity, electric railways, trams, etc. The current in use for these purposes is, as a rule, either the continuous or alternating, though the latter may be what is known as "three-phase current." The relative dangers associated with each variety will be discussed below, under Consequences of Electric Shock.

Electricity is used industrially chiefly as a source of power or of light.

**Electric Railways.**—Owing to the weight of the trains, which have to be got into rapid motion within a short time (noticeable in the Tube railways), the current used has to be high.

The voltage at which it is supplied is usually 500. The maximum effect from this is produced by keeping the resistance of the system down very low. For this purpose the current is carried on a very good conductor, whose resistance is extremely low. This constitutes the third rail, an example of which may be seen in the Central London Railway, where a stout rail runs by itself in between the two others on which the train runs. The locomotive carries a "shoe," which is held by springs in good contact with the third rail, and supplies current to the motors on the train. The circuit is completed through the wheels of the train to the rails, which form in this way an earth return. The third-rail system is only available for Tube railways, where the track is not easily accessible to the public, and

would be quite unsuitable, for instance, on roads as a tram system.

In the Central London Railway the tunnels, which are lined with cast iron, help to form an earth return.

The track rails are "bonded" (put into electrical contact) at each point, and are also "cross-bonded" every 60 feet, and at certain places are bonded to the tunnel iron walls.

The railway, unless very short, cannot be supplied simply with direct current from generating-stations, but is supplied from substations along its course.

In the Central London Railway electrical energy is generated as three-phase current at one end of the line, and transformed into direct current at a number of substations.

A three-wire system may be made use of, in which the earth return is formed by the rails, on each side of which are insulated conductors, each with a pressure of 500 volts.

*Long-Distance Railways.*—In some cases overhead wires (three-wire system) are made use of, in which case the voltage is very high (3,000), and has to be reduced down to suitable pressure on the locomotive. Owing to the very high voltage, strict precautions are necessary to avoid accident.

**Electric Trams.**—1. *Trolley System.*—The energy required is generated by dynamo, which is coupled up with one terminal to the overhead wire, the other to the rails on which the car runs.

The current passes to the motor on the tram by means of the trolley pole, and from the motor by the truck and wheels to the rails, or "earth," which forms the return circuit.

The end of the trolley pole has a wheel which runs on the overhead wire. The pressure used is, as a rule, 500 volts, and great care is necessary to prevent leakage to earth, with the possibility of shocks.

Further, as it is undesirable that the current should leave the "earth return" (the rails), these are "bonded" together (put into good electrical contact) by suitable means, at fairly frequent intervals.

2. *Conduit System* (as in the London County Council tramways).—In this case there is no overhead wire, and the earth return does not take place by means of the rails on which the car runs.

A conduit runs beneath the track in which run rails, attached respectively to the positive and negative poles of the dynamo.

They are not in contact in the conduit.

A narrow slot communicates through the road with the conduit below.

This may be seen between the lines in the London County Council tramway systems.

The car carries a "plough" on its under surface, consisting of a narrow metal instrument which can pass through the small slot in the ground and gain access to the two conductors below, fitting in closely between them. In this way the necessary current is obtained for the tram. The voltage at which these trams are supplied is, as a rule, 500 volts.

**Electric Light.**—(a) *House Lights.*—Electricity is supplied at different voltage in different areas, but in London is mostly at 240 volts continuous current.

Far lower voltage will produce a good light. Sixty-five volts are usual for lighting ships, but even much less than this will light a house. The reason for the high voltage supply in London is a purely commercial one—that of the expense of the copper conductors.

The amount of electricity required for lighting can be got through a small conductor if the voltage of supply is high, but if the voltage is low, then the size of the conductor must be increased to get the same amount of electricity through it.

As the conductors are made of copper, it is cheaper to have a high voltage and a small copper conductor than a low voltage and a large conductor.

From the company's mains insulated wires run to each house, and terminate in two main fuses, from these a positive and negative cable are run into the consumer's premises, and, passing to his main switch, are connected to his main fuses. One of the cables is divided before it reaches the fuse, and the consumer's meter is inserted into the circuit between the two cut ends of the divided cable.

From the main switch a pair of conductors go to the distributing board, from the small fuses of which pairs of conductors pass to the various groups of lights.

Each fuse on the distributing board is usually rated to carry 3 ampères current.

The switches which control the lights must be introduced on one of the wires from the distributing board. Care must be taken not to fix this switch on the earthed wire (the positive), as if this were the case anyone turning on the switch would possibly receive a severe shock.

As a rule, no joints should be made on any of the wires throughout the house.

The wires which are run about a house must be provided

with adequate protection, either in the shape of steel tubes (the wires are, of course, themselves insulated, usually by india-rubber) or wood casing.

The Institute of Electrical Engineers has issued special rules for wiring and for precaution necessary in connection with switches, fuses, etc.

(b) *Street Lights*.—The arc lamp is the type most often employed for this purpose. Lamps of this kind are arranged to work either in series with separate high-tension currents, or from the distributing mains which supply private houses. The difference in voltage between the two arrangements is considerable, as the private supply is not higher than 240 volts, whilst separate high-tension currents may have several thousand volts pressure.

As a rule, continuous current is used for arc lamps, as this gives a better result than the alternating current. When the available current is an alternating one, it is usual, if possible, to “rectify” this current and transform it into a continuous current before sending it to the lamps. This is accomplished by means of an instrument called a “commutator.”

If a continuous-current dynamo is used, it is usually constructed in such a way that the current remains constant under all circumstances. To obtain this end the electromotive force has to be varied with the number of lamps burning at any particular time. Directly the current becomes greater than that required for the lamps at the time, the electromotive force is automatically reduced. A short circuit may occur in a system of this kind without the production of a dangerously large current.

Arc lamps require about 50 volts per lamp, but when arranged in series ten lamps can be run from 400 volts or five from 230 ; with special carbons three lamps can run on 110 volts.

(c) *Ship Lights: the Ship Return System*.—Under this arrangement the current, after passing through the lamps, is carried back to the dynamo by means of the steel or metallic deck or sides of the ship.

One terminal from the dynamo is “earthed,” or in this case “shipped.” As a result of this arrangement, if the insulation of the distributory wire to the lamps becomes at all defective, a slight shock may be somewhat more easily obtained than under ordinary circumstances by anyone coming in contact with the faulty insulation. This would be rendered more easy still in bad weather, when the decks would be wet ;



the resistance offered to the short circuit from the wire to the ship would be reduced. The voltage, however, at which the current is supplied is not, as a rule, very high—rarely over 65 volts—so that the shock is negligible under ordinary circumstances.

### The Consequences of Electric Shock.

(i.) **Nature of Current : Alternating and Continuous.**—Is a continuous or alternating current more deadly? This is a difficult question to answer, but general opinion rather points to the alternating as being somewhat more dangerous than the continuous. Four instances have lately been recorded where a shock from a hand-lamp, with an alternating current under 300 volts electromotive force, has proved fatal. The contact was fairly good in each of these cases, and the man receiving the shock was very well “earthed,” standing on metal plates or on damp ground, either of which would put him into good contact with earth. On the other hand, the continuous current is perhaps more liable to produce burns, especially at the positive pole.

The returns of the Chief Inspector of Factories (1907) for six years show only three deaths from continuous currents, as against thirty-three deaths from alternating, but we have not been able to ascertain the proportion of factories using continuous currents to those using alternating.

(ii.) **The Quantity required to produce an Effect.**—With regard to the amount of current required to cause a muscular contraction in man, about 3 milliampères (1 milliampère is  $\frac{1}{1000}$  ampère) applied through the skin will produce a slight contraction. This is unattended with any pain. A current of 8 to 10 milliampères becomes unpleasant, producing strong muscular contraction and a hot, burning feeling at the site where the electrodes are applied; 20 to 30 milliampères, if applied gradually and from large electrodes, is not very painful, but if suddenly applied gives rather painful shocks; and above this strength, if the current is abruptly turned on or off, the result is severe and painful. This brings one to consider how much current can be taken by a human being. According to Lewis Jones, 200 milliampères have been taken without harm resulting; probably a fatal quantity might be regarded as 500 milliampères ( $\frac{1}{2}$  ampère). As we shall see, however, large currents of this kind which do not prove fatal may produce very severe burns, especially if applied over a small area.

(iii.) **The Effects of Electricity upon the Body.**—(a) *Effect upon Muscles and Nerves of Single or Repeated Shocks with Small or Large Currents.*—One of the first steps towards knowledge of this subject was made when Galvani obtained a contraction of the muscles in a frog by means of a small electric current. He produced the current accidentally by the contact of two dissimilar metals (copper and zinc) with the nerve going to the muscles of a frog's leg. This showed clearly that a muscle will respond to an electrical stimulus applied to its nerve, provided the stimulus be of sufficient strength. This contraction will take place with any form of current, continuous or alternating. To a single stimulus or shock the muscle responds with a single twitch; if repeated shocks are applied to the muscle, there will be a contraction to each individual stimulus, provided a sufficient interval occurs between them. If the interval is reduced till the shocks follow each other in rapid succession, the muscle goes into a condition of continuous or tonic contraction, which is known as "tetanic contraction."

If the current employed is very strong, the muscles may go into a tetanic contraction with single shocks. This is one of the great dangers of shocks from high-pressure circuits. If a live wire or conductor of a current of high voltage is grasped by the hand, the muscles of the arm go into a continuous or tonic contraction, and their owner is quite unable to voluntarily relax them and so release the object grasped. He may be able to cry out. If, however, the current through him is very high, all his muscles will go into tonic contraction, and he will be unable to make the slightest voluntary movement of any sort or to cry out. Such a shock is likely to prove fatal, either at once or somewhat later, after the man has been released from the contact. Even if the accident occurs in such a way that no grasp of the conductor is possible, an involuntary muscular contraction may still take place, and the man may be thrown down violently or to some distance.

When a serious shock is sustained, a feeling as of a severe blow is experienced, unless consciousness be at once lost. A cry may be produced which is of an involuntary nature, due to muscular contractions. It resembles in this respect the cry which is often heard at the onset of an epileptic fit. If unconsciousness is produced, the breathing will be deep and slow, the pulse small and feeble, the pupils dilated, and a frothy mucus may escape from the mouth. It has been shown that as a rule the heart is affected to a greater degree

than the respiratory apparatus, but much depends on whether the heart actually comes in the direct path of the current. Life may sometimes be saved, however, by immediate recourse to artificial respiration. If the man recovers, the immediate effects of quite severe shocks are usually of a very transient nature. A state of physical depression, with or without temporary paralysis, may exist for a few days after the accident, which may be followed by neurasthenia.

(b) *Burns*.—Severe burns, which in some instances have caused gangrene, may also be found on the parts of the body at which the current has passed in (anode) and out (kathode). The burns produced at the anode with a continuous current usually appear to be the most severe. Certain conditions tend to cause severe burns. Probably dry skin is more likely to be burnt than wet, though Olliver (Clifford Allbutt, "System of Medicine") holds a contrary view. To produce burns, the important point is that the quantity of electricity shall be large—in other words, that the ampère shall be high. This can be produced by either a great voltage or long exposure.

In the human body a burn is produced by what one might call concentration of electricity. A large quantity of electricity—*i.e.*, many ampères—will produce a burn of a large area; a far smaller number of ampères may burn if the area of contact be very small. So, too, a long application will cause a burn, as in course of time the quantity of electricity actually applied will be large. A very high voltage produces the same effect, as a high voltage, or pressure, can drive a great quantity of electricity in a short time through the skin. So burns are produced by many ampères, or high voltages, or long time, or small points of contact.

Burns are produced, probably, by a great volume of electricity, a large number of ampères coming suddenly against a great resistance.

This is the principle of the fuse. A wire of higher resistance than the conductor is introduced into a circuit, so that if the quantity of the current is raised above a certain degree, although the main wire can easily carry it, the fuse wire cannot. Heat is generated in the fuse by the current overcoming the resistance in the same way that heat usually is generated by force acting against the resistance of friction. The temperature of the fuse rises, and, as it is specially made of a mixture of metals that will melt at a low temperature, it melts—*i.e.*, the fuse "blows." A like result will occur in the human body.

A large ampèrage is presented to it, obstructed by the resistance. The "friction" of attempting to get over the resistance raises the temperature, and a burn takes place. This result is independent of the other phenomena associated with the effects of high voltage.

(iv.) **The Human Body as a Conductor, and the Measure of its Resistance.**—(a) *Conductors.*—The human body intact and with a dry skin is an exceedingly bad conductor of electricity. The tissues of the body other than the skin are fair conductors, the nerves being the best. So that for practical purposes the skin is the worst conductor in the body. Clothes when dry make the body a still worse conductor, or, in electrical language, they add to the resistance, but thoroughly wet clothes, in good contact with the body, may moisten the skin, and so produce one or other of two effects: Either they conduct away the electricity to the ground (which would be likely to happen if a man sitting down in the wet was struck by lightning), or, on the other hand, they may conduct the electricity into the wearer's body by making a close contact and moistening his skin.

(b) *Resistance.*—As has already been mentioned, the dry human skin is a very bad conductor of electricity, and offers a high resistance to its passage. It is probable that the hard, horny cells of the surface of the skin—the epidermis—is the part which offers the greatest resistance; for although it is true that this layer is thin, yet it must be remembered that an exceedingly thin sheet of glass efficiently stops the flow of electric current. That it is this part of the skin which offers the chief resistance is indicated by the influence of moisture, for the deeper layers of the skin are permanently wetted by the natural fluids of the body, and so will be unaffected by dampening the outside skin.

The resistance of the dry skin varies much in different parts of the body and in different individuals; the thick, hard skin on the palms of the hands and the soles of the feet offer the greatest resistance. Under these circumstances the electrical resistance of the body varies between 20,000 and 200,000 ohms; the resistance of the dry skin probably rarely falls below 20,000 ohms.

This resistance may be lowered by anything which eliminates the effects of the surface layers of the skin. Moisture and certain chemicals are most efficacious in this respect. Dr. Lewis Jones found by passing needles through the skin of the

shoulders, and then testing the resistance of the body, that only 500 ohms resistance was registered. As water is a fair conductor, moisture has been the cause of many fatal accidents through contact of the damp skin with conductors charged with electricity. Had the skin been dry, little or no effect would have been produced.

Dryness, or moisture, as the case may be, is the explanation of the enormous difference between the harmless results of the electrical experiments which are mentioned below and fatal accidents which have occurred with much smaller currents. In some of these fatal accidents, we suggest that soap, which contains a caustic alkali, tending to remove and soften the hard surface layers of the skin, or some other chemical producing the same effect, is partly responsible for the fatal result, in addition to the influence of moisture alone.

In considering the experiments and accidents below, the voltage of the currents is given, but not the ampère which flowed through the body, though the latter may be easily calculated by Ohm's Law. The voltage of a current is of immense importance, as the voltage is the pressure which drives the electricity through the body. No matter how many ampères are presented to the body, provided none get through no effect is produced at all. The water-pipe simile may be used again. Two exactly similar pipes may be connected to two identical filters—the one in connection with a very large volume of water representing many ampères at very low pressure, representing low voltage, the other connected with much less water, but at high pressure. Some water is forced through the filter connected with the high pressure, but none through the other. The water which gets through represents the ampères of current; the pressure of water corresponds to voltage. In actual fact, the number of ampères which are able to get through a body and yet not produce fatal results is exceedingly small, and are measured in milliampères or thousandth parts of an ampère, 500 milliampères, according to Lewis Jones, being probably fatal; but to produce this current with a perfectly dry skin a very considerable voltage would have to be employed. The following are the five varieties of resistance under which accidents have happened or experiments have been conducted on human beings:

1. The dry skin.
2. The dry skin with dry clothes (boots, etc.).

3. Damp clothes (boots, etc.), damp skin.
4. Chemically treated skin.
5. Without skin.

(1) *The Dry Skin*.—The effects of experiment upon the dry skin with very high voltage are so extraordinary as to be almost incredible, and we cannot recommend our friends to repeat these experiments unless they are prepared to undertake the risk of the presence of moisture.

The normal dry skin of man offers a resistance of 20,000 ohms, and Ohm's Law shows that to get half an ampère, the fatal quantity, through this resistance 10,000 volts will be required.

For since  $C = \frac{E}{R}$ , R is 20,000 and C is  $\frac{1}{2}$  ampère, therefore E is 10,000.

The *Journal of the Institute of Electrical Engineers* for 1902 quotes a full discussion and numerous experiments, the account of many of which, especially those by Mr. Trotter, is described. He found that 500 volts are not dangerous under certain circumstances, even if one contact is made through the hand when it is dry.

It does not follow from the experiments to be quoted that 500 volts are not dangerous under any circumstances; but under the circumstances quoted they were not. But if good contact with a naked and damp skin were made, the resistance would be much less than with dry skin, and a very severe, possibly fatal, shock would certainly occur.

(2) *The Dry Skin with Dry Clothes*.—These will raise the resistance. Trotter recorded the results of his experiments on himself under which 500 volts contacts were relatively harmless. He stood on the rails of the South London Railway (500 volts) in dry boots, and also sat on the live conductor and slapped the running rails, without any inconvenience. He grasped the trolley wire on an electric tram (500 volts) with no effect. His son, aged seven and a half, stood on the rail of the tram in new boots and played with the trolley wire, and felt nothing.

Current less than  $\frac{1}{4}$  milliampère was found to be passing through his son, which makes his resistance under these circumstances = 2,000,000 ohms.  $R = \frac{500}{\frac{1}{4} \text{ milliampère}}$ .

Resistance through boots, if they are dry and without nails, varies from about 45,000 to 200,000 ohms. Trotter found that ordinary nails, not hob-nails, in boots, made no difference.

(3) *Damp Clothes, Boots, etc., and Damp Skin*.—Standing on

damp granite sets and grasping the trolley wire of an electric tram produced a current of 15 milliampères ( $R = 33,000$  ohms). In old boots with holes in them, after walking two miles on damp pavement, more shock was felt, and 35 milliampères was registered by an accurate instrument as passing through the experimenter ( $R = 14,000$  ohms). A platelayer in the open road of the Waterloo and City Railway sat accidentally on the live rail (of 500 volts), and made contact to earth with his wet boots. He shouted out, and had to be pushed off the rail, as his muscles went into tonic contraction. A man wearing wetted boots and in holes gave 13,000 ohms resistance.

Lewis Jones records the cases of two men killed at Fulham after having a bath; whilst still wet they touched a lead pipe which happened to be "alive," owing to faulty insulation. The pressure of the current was only 200 volts. Now, if such comparatively low tension will cause death under *these* conditions, it is quite clear that the same voltage or lower under *other* conditions of contact and resistance might at least give rise to severe shocks.

(4) *Chemically-treated Skin*.—Chemicals, especially caustic alkalies, soften, and even destroy, the hard horny layers of the skin; so a prolonged washing in hot water which contains some soda would render the hand a doubly good conductor when wet, for it would not only soften the surface layers, but would also completely damp the skin.

As an instance of how small a voltage may prove fatal, we have the oft-quoted case of the man who was standing with his bare feet in a mixture of cane-sugar and potash, and who made connection with a current at 65 volts. This proved fatal. The contact made must have been good, and the man offered an easy path of escape for the current by being so thoroughly well earthed; the potash and sugar mixture was not essential for the shock to prove fatal, but probably the potash softened the hard, superficial layer of the skin, and so practically destroyed the resistance of the skin. Potash easily destroys the surface layers of the skin. This case must, however, be regarded as very exceptional if not doubtful; for, taking the resistance of the tissues at their lowest value, it would be probably not less than 200 ohms. With a voltage of 65 the current would work out at  $\frac{65}{200} = \frac{1}{3}$  ampère (about), and such a current (333 milliampères), though sufficient to cause a severe shock, would not as a rule prove fatal.

The above facts no doubt throw light on those cases where a shock of under 200 volts has proved fatal, whereas shocks from over 2,000 volts have not done so. Quite apart from the possibility that the men killed by the lower voltage may have been the subject of some disease, difference in contact and resistance will well explain the apparent anomaly.

(5) *Without Skin* (i.e., by eliminating the resistance of the skin).—Lewis Jones passed a current through needles which pierced the skin of the opposite shoulders, and then tested the current that was flowing; he found that 500 ohms was registered as the resistance of the internal parts between the shoulders. This clearly shows how the high resistance of the body with skin intact is almost entirely the resistance of the skin.

(v.) **Death from Electricity.**—This form of death always occurs with signs of “shock,” in the medical sense (collapse). Though there may be some spasm of the muscles as long as contact is maintained, there is none after contact is broken.

Various ideas have been held on this subject. D’Arsonval originally contended that death from electrical shock arose in one of two ways:

1. Direct action by mechanical disruption.
2. Indirectly or reflexly by acting on the nerve centres which control the respiratory centres.

Death was due, in his opinion, to respiratory arrest, and he went so far as to state that criminals electrocuted in the United States died rather from their “post-mortem!” examination than as the result of electric shock. In support of his argument, the cases of men who have been apparently dead and have been resuscitated by artificial respiration have been quoted.

1. High-pressure shocks act directly on the respiratory apparatus, causing death by asphyxia.
2. Low-pressure shocks act directly on the heart, throwing it into fibrillary contraction (rapid fine quivering contraction).

The path of the current through the body is an important one. If a vital organ, especially the heart, lies in the direct path of the current, the shock is more likely to prove fatal. Again, abnormal physical conditions may render a shock more severe than under normal circumstances—e.g., if the recipient has heart disease. Persons under the influence of alcohol or sleep, on the other hand, would seem to be less susceptible—a fact which points to the nervous system as playing, at any rate, a part in the process.

The condition of the skin, as we have seen, is of the utmost



importance. Some individuals have a harsh, dry, thick skin naturally, whilst others have a thin and moist one; the latter would suffer more severely than the former under similar electric conditions.

The number of accidents recorded annually as a result of shocks from electricity is certainly an increasing one, a fact which is, no doubt, due to the great development which is taking place in the use of electric power in industrial enterprises.

The number of shocks complained of remains, however, a comparatively small one. The following figures are from the annual report of the Chief Inspector of Factories and Workshops, and record accidents due to electricity which occurred in the year 1907, either at electrical generating-stations or in factories :

Non-fatal, 251.

Fatal, 9 (1 suicidal).

In none of the fatal cases was the current under 200 volts.

### Lightning.

**Immediate Effects.**—The effect of lightning on the body and clothes varies very much. Burns may be found, sometimes of a very extensive nature. They are seldom very deep on the parts of the body covered with clothing, but are usually limited to those parts beneath some metallic object, as a watch, keys, etc. To a certain extent, wet clothes seem to act as a conducting medium, and may thus possibly protect the body from the more serious injury which might have been sustained if the clothes had been dry. Frequently the clothing, whether dry or wet, is torn; the boots especially very often show the result of the violence of the shock. They may be completely torn off. The skin, besides being burnt, sometimes shows peculiar arborescent markings; these are produced by the spread of the discharge, causing an inflammatory reaction in the skin over which it has passed. When a man has been killed by lightning, there may be no mark of any sort whatever to show how he met his death. In some such cases, even on post-mortem examination, nothing further is revealed, but in other instances bleeding (hæmorrhage) in or around the brain has been observed, as in the case recorded by Hennessy in the *British Medical Journal*, 1889. On the other hand, the disruptive effects of the lightning shock are at times very marked, and the body may show wounds which resemble those that might be caused by actual violence with a somewhat blunt dagger.

Bones may be broken, as in the case recorded by Wilks (*Transactions of the Clinical Society, London, 1880*), where the bone in the lower part of the leg (right tibia) was fractured, and the heel-bone (*os calcis*) smashed up altogether. Death may be instantaneous.

In non-fatal cases, where the shock is at all severe, consciousness is nearly always lost. It is recorded by those who have recovered that there is no great sense of pain experienced, but often a feeling of intense pressure. The man struck, if conscious, is always more or less dazed. If unconsciousness be present, he will exhibit the symptoms of a man suffering from concussion of the brain. There will be muscular relaxation, flabbiness, the breathing will be deep and slow, and the pupils of the eyes widely dilated. The pulse, as a rule, will be found frequent and feeble. Loss of consciousness may be accompanied by delirium, and sometimes by a certain amount of fever.

After consciousness is regained, there is usually a fairly rapid and complete recovery, except so far as the burns are concerned. These may be somewhat slow to heal.

On the other hand, paralysis associated with loss of sensation in the paralyzed limb or limbs may occur. Where this has been caused by hæmorrhage into the brain, the paralysis is likely to be lasting; but cases occur where no organic lesion of this nature has taken place, and such may be confidently expected to recover. When paralysis occurs, it is much more often of this temporary nature than permanent. Instead of paralysis, convulsions or twitchings may occur, and be repeated from time to time. The mental condition may also be affected, resulting in insanity or in delusions of sight or hearing. Temporary loss of speech seems by no means uncommon, whilst the patient may be blind or deaf as well, and these conditions may remain permanently in a very few cases.

**Remote Effects.**—In the majority of the cases which do not die there are no remote effects of a lightning shock, but in some few instances these do occur.

There may be either permanent blindness or permanent deafness, resulting from injury to the nerve of the eye (the optic nerve), or from injury to the ear or its nervous connections. Lightning burns may prove obstinate, perhaps not healing for several months, and, as is common with all burns however arising, contracted limbs may result from the scars. Paralysis as described above under the immediate effects may persist, and the patient be permanently crippled. Nervous symptoms are,

perhaps, the most likely to remain, and the patient may become epileptic, neurasthenic, or insane. In neurasthenic cases the patient will complain of inability to do his work, of loss of memory and of energy, and of pain affecting the abdomen, back, or head. He will also be found to be entirely devoid of self-confidence. Such symptoms may be simulated with a certain amount of ease, and the usual great difficulty will arise in discriminating between the true neurasthenic and the malingerer.

### Disease.

Caused by the Electrical Accident, whether Industrial, or Lightning.—

1. Scars from healing of burns.
2. Possibly loss of a limb from severity of burns, which may be followed by gangrene.
3. Neurasthenia.
4. Hysteria.
5. Epilepsy.
6. Permanent paralysis, due to injury of nerves, spinal cord, or brain. This is very unlikely to occur.

With the exception of (1) all of these are very rare.

### Cure.

With regard to the time occupied in affecting a cure after injuries by electricity, it is impossible to speak in dogmatic terms. Everything depends upon the nature and extent of the injuries. Each case must be judged on its own merits. At the same time it is remarkable how very soon almost everyone recovers entirely, or did so before the Workmen's Compensation Act. Most of the slighter accidents produce nothing more serious than a few days' disablement.

With regard to the nervous phenomena which result from an electrical accident, it is impossible to fix any time limit. Very rarely a person, already predisposed by a naturally weak nervous system, may as the result of such an accident become neurasthenic, the duration of which condition is indefinite. One would say, however, that, short of any grave physical injury which may produce permanent destruction of the nervous tissue, resulting in either paralysis, epilepsy, blindness, or deafness, the other disabilities following an accident are susceptible of cure, although such cure may be delayed. Serious injuries

usually produce death, though non-fatal injuries are commonly rapidly cured.

**Burns**, which no doubt are the most common physical injuries which result from electrical accidents, may sometimes prove very intractable, and continue unhealed for weeks.

#### Return to Work.

What has been said above with regard to cure may be repeated on the subject of work. This only must be borne in mind, that a man may seem to all intents and purposes fit to work, and yet may state that he is unable to do so. It does not in the least follow that he is really capable of doing work, and, as we shall have occasion to note under the heading *Diagnosis*, it requires an expert to decide whether the man's statement is genuine, or whether he is merely playing up to his injury. The mental condition (*neurasthenia*) which may follow the accident may be quite sufficient to render work impossible, though the man's physical condition may seem excellent.

#### Recurrence.

There is no risk of recurrence of the consequences of an electric shock.

#### Occupation Diseases.

Other than the shocks received by employees exposed in electric generating-stations and on the distribution of electric current, there is only one form of occupation which involves electricity, and at the same time may be said to produce an occupation disease. This comes from the long-continued use of X rays, without taking proper precaution against their effects upon the human body. (See X Rays.)

#### Diagnosis.

(a) **Industrial Electrical Injuries.**—The chief difficulties will occur in the cases of those who have received, or assert that they have received, injuries from wires or conductors of any sort carrying heavy currents.

The difficulty which arises first of all is to estimate properly the actual effect of the shock in producing what may be termed organic disease—*i.e.*, where some structural effect can be demonstrated—and to distinguish such affections from those of a psychical character. For instance, Dana records (*Medical Record* of New York, vol. xxxvi.) the case of a man who had

on one occasion seen another man killed by an electric shock. Shortly afterwards the man was very lightly touched by an overhead telegraph wire which had fallen down. He took hold of this with his hand, and immediately fell down unconscious, and remained so for several hours. On regaining consciousness, he was found to be paralyzed in the arm and leg on one side, and to have lost all sensation in his paralyzed limbs. His vision was also impaired, as he was found to have his visual fields much reduced, especially on his paralyzed side. It was proved conclusively that there was *no electric current* in the fallen wire, and the symptoms which followed were purely hysterical, the result of auto-suggestion. Be it noted that this man was not malingering, and that for the time being his disabilities were very real to him. This, of course, is a very extreme case, but others will be met with in which some actual injury has occurred. From the gross effects of this the man may have apparently recovered, and yet he may assert that he is, and may actually be, unfit to resume his work again. In other words, he may suffer from what is known as "traumatic neurasthenia." The fact that he may quickly recover after any compensation claims are settled does not indicate that his inability to work, etc., was simply pretence. No doubt the uncertainty of success in the claims put forward militates greatly against complete recovery, and when this uncertainty has been satisfactorily removed his chances of cure are much improved. Of course the difficulty will always arise as to how far the man's statements are accurate, and how much of his case is genuine. In deciding this, one has to consider the extent of the injuries which he actually received, the time taken to recover from the actual injuries, and also the man's general condition previous to the accident. If he has suffered before from various hysterical symptoms, it is almost certain that these will recrudescence after even a slight accident. (In deciding a claim, it must be clearly understood, under these circumstances, that the accident was not really the cause of the symptoms exhibited: the man has always been hysterical, and liable to hysterical manifestations under various influences which would be without effect on another man of normal nervous constitution.)

(b) **Lightning.**—With regard to injuries from lightning, the diagnosis, especially where the injuries are not fatal, is as a rule never in doubt, and cases are not often likely to occur where the question can assume an important aspect. It is important to remember, however, that a man may be struck by

lightning, and suffer from severe shock, with perhaps temporary or transient paralysis, without exhibiting any mark either on his person or on his clothes. This, of course, is the exception rather than the rule.

Again, owing to the disruptive effect which lightning sometimes has on the tissues, it may seem as though the individual has been injured by violence of human origin; for instance, the wounds may present the appearance of those from a blunt dagger or stick, even bones being broken.

### Malingering.

The question of malingering often arises with regard to electrical injuries. Employees and others get to know the effect of the electric current, and sometimes undoubtedly make use of their knowledge to put forward fraudulent claims. It is imperative under such circumstances to examine fully the probabilities of the statements made.

The questions to be settled are:

1. What current (*i.e.*, voltage and ampèreage) was present in the wire or conductor from which the alleged injuries or shock were received? This may prove to have been too small to produce any of the effects complained of.
2. Was the wire insulated? and if so, was the insulation destroyed at an alleged point of contact?
3. What injuries have been actually produced in the shape of burns on the clothes or skin? In any severe shock these burns are practically invariably present. If burns are present, are they such as might have been produced by electric currents, or are they self-inflicted?
4. Are the symptoms complained of compatible with the alleged injuries received?

Some electric stocks produce symptoms of collapse. This is a condition very hard to simulate. The malingerer usually imitates convulsions.

The Workmen's Compensation Act has made a great deal of difference in the complaints made. The medical attendant at one of the largest electric works in London has stated that since the Act men are always making trivial complaints, which to his mind border on malingering, even if they are not actually so.

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*For legal cases of Electrical Injuries, see CASE GUIDE: Electricity.*

# THE ELECTRICAL TESTING OF MUSCLES.

By C. M. HINDS HOWELL,

M.D. (OXON.), M.R.C.P.,

Physician to the Great Northern Central Hospital; and Registrar, with charge of the Electrical Department, of the National Hospital for the Paralyzed and Epileptic.

## Head-note.

ELECTRICITY has been employed as a means of diagnosis in certain kinds of paralysis. Before indicating the methods of testing and the extent of their usefulness, one must first make a few introductory remarks on the way the normal tissues react to the various forms of electricity.

## Technical Terms.

See Electrical Injuries and X Rays.

## Reaction of Healthy Muscles to Electricity.

Galvani, in the eighteenth century, first discovered that the muscles in a frog's leg could be made to contract by the nerve going to the muscles in contact with two dissimilar metals.

Volta shortly afterwards supplied the explanation of this new observation, and showed that a current of electricity had been generated in the process, and that this had caused the muscular contraction. We now know that, if a current of electricity be applied to a nerve or muscle, an impulse is started by the current which will produce a response from the muscle in the form of a contraction. It has been found that the various forms in which electricity may be applied will all produce muscular responses, but those most convenient for practical purposes are the continuous (galvanic) current and the faradic or interrupted current.

Now, a healthy muscle responds in different manners to these two forms of stimulus.

The continuous (galvanic) current produces a muscular contraction under two conditions.

(a) When the circuit is suddenly completed, closed, or made, through the muscle, a contraction occurs called the "closing" contraction.

(b) When the circuit is suddenly disconnected, opened, or broken, a contraction occurs called the "opening" contraction.

It is to be noticed that under ordinary circumstances no muscular contraction is produced during the period when a constant current is flowing through the muscle. The type of muscular response evoked is a single twitch (like, for instance, the blink of an eyelid) at the "make" and "break" of the circuit. It is essential to remember this, for we shall see that in certain forms of paralysis this type of muscular response changes.

The faradic or interrupted current produces a different form of muscular response. The contraction of the muscle lasts the whole time the current is passing. The explanation of this is that, as the faradic current consists of a whole number of individual shocks, like the make and break rapidly repeated, the muscle fibre has no time to relax after one response before a second stimulus reaches it, causing a second contraction. In fact, a continuous contraction, or "tetanus," is produced. If the faradic battery is so arranged that, instead of rapidly repeated shocks, only slowly repeated single shocks are given, the muscle will respond by a single twitch to each individual shock.

### Testing a Muscle.

In testing a muscle or group of muscles, two electrodes are used. One electrode (usually a metal disc covered with chamois leather, and attached to the positive or negative pole of the battery) is applied to the part to be investigated, and the other electrode, attached to the other pole, is put on the back or some other convenient place. Both electrodes must be thoroughly moistened (to lower resistance of skin) and applied with firm contact.

The response of the muscle to both forms of electric current (galvanic and faradic) is tested, because in certain cases of paralysis, to be presently indicated, the response to one or other of these may vary. As has already been mentioned, with the constant (galvanic) current a twitch will be produced when the current is "made" (*i.e.*, turned on)—"closing" contraction



(C.C.). A second twitch will occur when the current is "broken" (*i.e.*, turned off)—"opening" contraction (O.C.).

In the healthy muscle, as already stated, a prolonged contraction is produced by faradic stimulation, lasting the whole time the current is allowed to flow.

It is evident, when dealing with the constant current, that the stimulating or active electrode may be either the anode or kathode (see Technical Terms), according to the direction in which the current is flowing. Now, experience has shown that the quantity of current required to produce a muscular contraction varies. This variation is further found to depend on whether the anode or the kathode is the active or stimulating electrode.

The healthy muscle will respond more readily when the kathode (negative pole) is the active electrode. With a small current—*i.e.*, 3 to 5 milliamperes—a contraction will take place when the current is "made" (turned on), but not when it is "broken" (turned off). To obtain a contraction at "break," much larger quantities of current must be used, about 15 milliamperes usually being sufficient.

The contraction produced on making or closing the current is spoken of as K.C.C. (kathodal closing contraction), that on breaking or opening as K.O.C. (kathodal opening contraction).

With the kathode as the active electrode, slightly less current is required to produce a contraction on making or closing the current than is the case when the anode is the active electrode (*i.e.*, K.C.C. is greater than A.C.C.) The opening contractions are different, and with these we have little or nothing to do, but about the K.C.C. and A.C.C. we shall have more to say.

### Changes in Electrical Reactions in Paralysis.

These changes have been designated the "reaction of degeneration," and are spoken of shortly as R.D.

A muscle which exhibits R.D. will react to electrical testing in the following way:

1. **Galvanic Stimulation.**—This response will be fundamentally different to the response obtained from a healthy muscle.

Contraction will take place as before on make and break of the current, but its character will be changed. Whereas the healthy muscle responds by a brisk twitch, the paralyzed muscle

will respond with a contraction which is essentially sluggish. The fibres, for example, of the biceps (the muscle which bends the elbow) in their contraction will resemble the slow wave which passes from one end to the other of a worm as it moves along, instead of a quick jerk.

This slow muscular contraction is the essential element of R.D., but a further change may also be noted.

*Polar Changes.*—Whereas in a healthy muscle K.C.C. is greater than A.C.C.—*i.e.*, the closing or making of a small current will evoke a greater response when the kathode is the active electrode than when the anode is so employed—where R.D. is present we find this state of things reversed, and A.C.C. is equal to or greater than K.C.C.

2. **Faradic Stimulation.**—The contraction may be very greatly diminished or be absent. If R.D. is present in its fully developed form, no contraction can be obtained from the muscle on faradic stimulation.

If the condition which has produced R.D. in a muscle or group of muscles persists, eventually the muscle loses its power of response to galvanic as well as faradic stimulation.

Under these circumstances the muscle will not respond to any form of electrical stimulus.

Other conditions exist in which the muscles may not exhibit R.D., and yet not react in a normal manner.

They may still react to both faradic and galvanic stimulus, but large currents may be required to make them do so. Their excitability is much reduced.

### Significance of the Altered Electrical Reactions.

Undoubtedly, if the electrical reactions are definitely abnormal, some accident or disease is responsible for this. On the other hand, the electrical reaction in a paralyzed limb may be quite normal, yet the paralysis may be the result of some definite and demonstrable cause, and not simply an hysterical manifestation.

The so-called “voluntary muscles,” or muscles which act under the direction of one’s will, are controlled by means of the nervous system. If a muscle is voluntarily made to contract, this movement is the result of an impulse which originates in a certain part of the brain—in a brain cell—and travels along the nerve fibre given off by this cell; this nerve fibre reaches the spinal cord, and there gives off small branches to a spinal cord cell.

From this spinal cord cell another nerve fibre starts, which leaves the spinal cord and passes down the nerve to the muscle in which it ends.

There are, then, two main lines and a junction along which any impulse has to pass to evoke a muscular response—an upper and a lower. The upper consists of a cell in the brain and its fibre to the spinal cord cell (the junction). The lower consists of the same spinal cord cell and the nerve to the muscle.

If the upper line is interfered with, there will be paralysis, but no change in the electrical reaction.

If the lower line is interfered with, there will be paralysis and the change in the electrical reactions which we have spoken of as R.D.

The reason for this is as follows: The maintenance of the nutrition or healthy condition of the muscle depends upon the spinal cord cell, the junction, being healthy and connected with the muscle, whereas the fibres which run from the brain to the spinal cord cell are chiefly used for conveying orders to the muscle as opposed to the mere maintenance of its health. So that if a nerve fibre is injured in the upper main line before it reaches the junction, voluntary movement is impossible, but the spinal cord cell continues to look after the health of the muscle. In consequence we get a paralyzed muscle that does not waste, except from disuse, but one which the will cannot make contract. In other ways, however, it is in quite a healthy condition, and shows the normal responses to the electrical test; *i.e.*, it does not give the reaction of degeneration (R.D.).

If, on the other hand, the lower line, the nerve fibre below the spinal cord cell, or the spinal cord cell itself becomes injured, we get paralysis and exactly the same phenomena as before as regards the will; for there is a breakdown on the line, and the impulses of the will from the brain still cannot travel to the muscles, only, in addition, the muscle is deprived of the organizer of its commissariat. As a result of this, degenerative changes occur in the muscle, which wastes in addition to being paralyzed; and when the muscle is tested electrically it gives the reaction of degeneration (R.D.). It is important to remember that after an accident, in which, for instance, a nerve in the arm is injured, two or three days may elapse before R.D. will appear in its typical form.

If R.D. goes on to complete loss of response in the muscle, the injury to the lower line we have spoken of must have been

severe, and recovery, if it takes place at all, will be a matter of many months (six to twelve).

### Malingering.

Although the alteration in the electrical reactions, to which reference has been made, indicates the presence of definite disease, the absence of alteration does not prove that no disease is present. Hence the electrical reactions cannot *by themselves* be relied upon to establish a diagnosis of malingering.

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*For legal cases of Electrical Injuries, see CASE GUIDE: Electricity.*

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## ENTERITIS.

*See* INTESTINES, LEGAL CASES.

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## EPILEPSY.

*See* BRAIN.

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## EPITHELIOMATOUS CANCER.

*See* GENERATIVE ORGANS—MALE (CHIMNEY SWEEP'S CANCER)  
—AND SKIN.

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## ERYSIPELAS.

*See* INFECTION.

# EXPERT EVIDENCE.

By A. P. BEDDARD

M.A., M.D., F.R.C.P.

Assistant-Physician to Guy's Hospital, and Lecturer on Materia Medica,  
Guy's Hospital Medical School; Physician to the West  
London Hospital.

## Medical Men as Expert Witnesses.

UNLIKE a common witness, who testifies only to facts which he has himself seen, it is the duty of an expert witness to give opinions upon, and to draw deductions from, facts, whether observed by himself or testified to by others. In addition, he must be prepared to criticize the views expressed by other experts. Should he happen to witness the actual occurrence of an accident, a medical man may, of course, like any layman, be called as a common witness; but for our purposes we shall consider only the position of a medical man who has made professional examination of the patient, or has had an account given him of the patient's condition, and is therefore eligible to give expert evidence on the patient's case.

The duties of the medical expert are considered in relation to the following points:

I. The collection of the medical evidence. The duties and difficulties of the medical expert—

1. As the private practitioner or club doctor attending the patient.

(a) The examination of the patient.

(b) Verification of the symptoms.

(c) Making and keeping of notes.

(d) Diagnosis and prognosis.

(e) Reports.

(f) Treatment.

2. As the medical expert on behalf of those against whom the patient is making a claim.

3. As a consultant who is called in to examine the case, or who has treated the patient in a public hospital.
- II. Consultations before going into court.
1. Joint consultation with the medical men for the other side.
  2. With counsel to his own side.
- III. Legal obligations of the witnesses.
1. Obedience to a subpoena.
  2. Professional secrecy.
- IV. The conduct of the expert witness in court.
1. The giving of evidence.
  2. Qualities of the ideal expert witness.
    - (a) Knowledge.
    - (b) Fairness and candour.
    - (c) Temper.
- V. The examination of the expert witness in court.
1. Examination-in-chief.
  2. Cross-examination.
  3. Re-examination.

#### COLLECTION OF THE EXPERT EVIDENCE.

Medical men come into relation with accident cases in three capacities, which must be considered separately, as each has its particular duties and difficulties :

1. As the private practitioner or club doctor attending the patient.
2. As the usual medical expert on behalf of those against whom the patient is making a claim.
3. As a consultant called in to examine the case, or who has treated the patient in a public hospital.

##### 1. *Duties of the Medical Expert as the Private Practitioner or Club Doctor attending the Patient.*

As the patient's doctor, his chief duty is to observe and record, to diagnose and treat. His main difficulties are that he is dealing with a private patient, who very often expects him to take an unduly serious view of the injuries received.

His duties may be considered under the following heads :

- (a) Examination of the patient.
- (b) Verification of the symptoms.
- (c) Making and keeping of notes.
- (d) Diagnosis and prognosis.
- (e) Early reports.
- (f) Treatment.

(a) **Examination of the Patient.**—An early and complete examination of the patient is essential. This should include not only those parts which are said to be injured, but also the systems and organs of the entire body. Negative evidence may be just as valuable as positive; later on it may be as important to say that certain symptoms were at first absent, as that others were at first present. Further careful search should be made for physical defects or the results of old accidents, in order to prevent their being ascribed to the accident for which a claim is being made. We have seen a leg wasted by old infantile paralysis fraudulently attributed to a recent accident. The patient in question first drew the doctor's attention to his leg three months after the accident, and owing to the fact that the doctor had never previously stripped the man and examined his legs, he was not in a position to say at once that the wasting of the limb had occurred prior to the accident.

(b) **Verification of Symptoms.**—The symptoms complained of by the patient are of two kinds—objective and subjective. The objective are the more important only because they can be verified. Every objective symptom complained of should be carefully investigated, and its presence or absence determined by the most conclusive methods. Thus, wastings, swellings or shortenings should be determined, not merely by the eye, but also by measurement; whilst injured bones and joints should be examined by the X rays. Not infrequently, however, cases are brought into court in which vomiting, diarrhœa, loss of weight, or loss of blood from the stomach or bowels, etc., are complained of, and yet the medical man attending the case has never seen either the vomit or the blood or weighed the patient. Such negligence on the part of the medical man is unfair, not only to the patient, but also to the other side, and is likely to lead to the doctor having a bad time in the witness-box. Subjective symptoms—*e.g.*, pain,

headache, lassitude, inability to concentrate the attention, etc.—cannot be verified by direct examination, and their presence can only be inferred from watching the patient. When such symptoms apparently form a prominent part in the case, the doctor's first duty is to satisfy himself that they are genuinely present. Should he have any doubt about the *bona fides* of his patient, and not feel in a sufficiently independent position to express a doubt or adverse view, he ought either to call in another medical man in consultation, or send his patient to a home or hospital to be watched by independent observers. The importance of a thorough examination of the patient and the careful investigation of his symptoms cannot be exaggerated; for it is obvious that a diagnosis is impossible until it is quite certain what symptoms are genuine and require explanation.

(c) **The Making and Keeping of Notes.**—Careful notes and sketches should be kept of all cases of accidents from which a legal action can possibly arise. Such rough notes should be written and kept up to date each time the patient is examined, in order that they may be accurate and at the same time available for use in the witness-box.

These notes will form the basis of reports to the patient's solicitor, and the facts contained in them will be available for any other medical man who may have to examine the patient. Accident cases often extend over many months, or even years. It usually happens that no doctor sees the patient on behalf of the employer until several months after the accident, and therefore an accurate history of the patient's past condition and symptoms is essential to a satisfactory diagnosis. We have known many instances in which no such history has been kept, and nothing has been forthcoming but vague clinical impressions of the case, and this has rendered it difficult, if not impossible, to discover the truth.

(d) **Diagnosis and Prognosis.**—The diagnosis of a medical case consists of the probable explanation of the symptoms; occasionally the diagnosis is certain, but more often it is only an opinion based upon probabilities. The same is true of the effects of accidents.

In many cases only one explanation can be fairly termed probable, but in other cases there may be several reasonable but conflicting diagnoses, and then it is only to be expected that the medical men on either side will adopt the view most favourable to their own party.

Some doctors, however, when they have to deal with an



accident case, appear to throw probabilities to the winds, and, starting from the point that everything is possible, make diagnoses which can only be described as fantastic. Murmurs over the heart commonly occurring in anæmia are ascribed to ruptured valves; headache or pain in the neck is said to indicate meningitis; slightly increased "knee-jerks" may be put forward as proof of organic disease of the spinal cord; so that, instead of trying to explain as many symptoms as possible by one cause, nearly every symptom is put down to a separate disease or injury. If diagnosis is uncertain, how much more is prognosis—*i.e.*, the estimated probable duration of the symptoms based upon the assumption of the correctness of the particular diagnosis adopted.

(e) **Early Reports.**—As soon as the patient's solicitor contemplates making a claim for damages in respect of an accident, he calls for a report from the medical attendant. The claim is based chiefly upon the injuries received and the estimated length of the resulting incapacity, or, in other words, upon the medical diagnosis and prognosis. At an early stage in a difficult case diagnosis is often uncertain and prognosis impossible; therefore, in writing early reports, great caution should be exercised about expressing too definite an opinion either to patients or their solicitors, since both are apt to receive and act upon an early diagnosis and prognosis as a final expression of opinion on the part of the medical man. We have known doctors to have so committed themselves to a definite opinion in an early report, that they have scarcely felt in a position at a subsequent date to express a view less favourable to their patient's claim. Considerable pressure is often exerted by private and club patients upon the doctor attending them. This difficult position can be avoided with proper caution, but, should it arise, the medical man should insist upon calling in a second and independent opinion. Every medical man who examines an accident case will have to furnish a final report to a solicitor. A copy of this report will be given to the counsel, and will furnish the basis of the examination-in-chief of the witness in court. The report should begin with a statement of the date, time and place where the patient was examined, and should give the name and address of any other medical man who was present. Then should follow a brief account of the accident.

The chief points in the history of the injuries must be disclosed, symptoms and treatment up to date, giving in each case the name of the person who supplied the information.

Next the writer should describe in the simplest language the facts observed by himself. It is often unnecessary to reproduce in a report all the observations recorded in rough notes, but care must be taken to include those which form the basis of the opinions to be expressed. He should indicate whether he and the other medical men present agreed about the observed facts, and if not, in what respect they disagreed. It is most important when writing a report, as it is when in the witness-box, to distinguish between the facts observed and the inferences drawn from them; the latter should be kept together and should follow the record of facts.

(f) **The Treatment of the Patient.**—The treatment of the patient is necessarily based upon an accurate diagnosis. Sometimes it is simple and obvious, but often difficult and requiring considerable knowledge and experience. We are convinced that some accident cases, such as those suffering from unrecovered concussion, traumatic neurasthenia, traumatic lumbago, etc., drag on much too long, owing to imperfect treatment in the earliest and most important stages. Often, with the best intentions, but with disastrous results, these patients have been sent back to work too soon. In fairness to the patient and to the employer, who will have to pay for the term of incapacity, a medical man who is uncertain about the best treatment for an accident case should early call for a second professional opinion.

2. *Duties of the Medical Expert on behalf of those against whom the Patient is making a Claim.*

(a) **Examination of the Patient.**—Sooner or later a medical man will examine the patient on behalf of the employer. It is most desirable that the patient's own medical attendant should be present at this examination. The patient's own doctor should provide a full history of the symptoms and treatment from the time of the accident up to date, and should assist the other medical man in every way by supplying him with all the facts needed for a searching examination. He should answer any questions he can as to the medical history of the patient previous to the accident. It is usual at these consultations to discuss the diagnosis, the prognosis, and even the treatment. Some medical men welcome suggestions, but others apparently resent any discussion of their treatment, as if it were no concern of the other side.

It must not be forgotten that the employer is pecuniarily interested in the patient's treatment. For this he has to pay either directly or indirectly. He pays directly if the patient sue at Common Law or under the Employers' Liability Act; indirectly if he sue under the Workmen's Compensation Act—for the longer the man takes to get well the longer the master will have to pay him half-wages, though he does not have to pay for any medical attendance.

The medical man who is examining for the employer has many difficulties to cope with. He often has to diagnose a case which before he sees it has been running on for months. His diagnosis may depend largely upon a history the value and accuracy of which he has no means of estimating. Further, he has to make a prognosis in a case in which he does not control the treatment, and cannot alter it. These difficulties can be overcome only by a patient sifting of the facts and a careful examination. In many (but not all) cases, the history of the patient, his physical condition, and the symptoms of which he complains, all fit in together. On the other hand, the history may be extraordinary, the accident may appear unlikely to have caused the injuries, or the symptoms may not harmonize with the physical condition of the patient. Under any of these circumstances the medical man must try to avoid jumping to the conclusion that the case is fraudulent, as it may equally well be unusual; and in deciding what is true he must be guided chiefly by his own examination and the objective symptoms which he can verify. It is essential to remember that, just as functional nervous disturbance may accompany organic nervous disease, so exaggeration of symptoms, or malingering, may be associated with genuine symptoms and injuries. To prove that one symptom is due to malingering is not to prove that the whole case is fraudulent, and, on the other hand, because one part of a case is genuine, it does not follow that the whole is.

Another real difficulty in some cases is that the examining doctor is received with visible distrust by both the patient and his medical attendant, who appear to expect that he will poohpoo the symptoms and accuse the patient of malingering. As a rule he can gain their confidence by the exercise of tact and consideration, and by showing that his sole object is to find out the truth about the patient's condition. Occasionally the patient makes a difficulty about being examined, and, while it is important to show the patient every consideration, the

medical man should not be deterred, except by a flat refusal, from making as full an examination as he thinks necessary. He can as a rule carry his point by making it clear that the patient will seriously prejudice his own case in court if he refuses. If a workman refuses to be medically examined, or obstructs the examination of the employer's doctor, the Workmen's Compensation Act (1906) provides that he shall receive no compensation during the period of refusal to submit to examination. The medical man representing the employer is certain to adopt a diagnosis as favourable to his side as he conscientiously can; but he should be careful that his diagnosis is a reasonable and probable explanation of the symptoms. He has no excuse for treating subjective symptoms and functional disturbances as if they were either of no importance or merely malingering, unless he has good reason to think, and can bring evidence to show, that they are assumed or wilfully exaggerated. Neither has he any justification for dragging in some far-fetched explanation of the symptoms with the object of showing that they are not due to the accident, unless he can support such an explanation by evidence. It is necessary to remember that, if symptoms follow close on an accident, the presumption is that they are caused by the accident, and very good reasons must be given to persuade the Judge or jury to take the opposite view (*infra*).

The medical man should obtain an account of the accident from the injured man himself, though objection is commonly raised by his legal adviser, if present at the examination, to his answering any question whatsoever as to how the accident happened. The medical man may reasonably require an account of the accident to enable him to form an opinion as to whether or not the injuries could have arisen from the accident. We have not been able to discover any reported case in which the point has been raised; but it would appear that a refusal to give a fair account of the accident possibly would be held as an obstruction to an examination within the meaning of the Workmen's Compensation Act.

It is obvious that the most important piece of evidence in connection with an accident—viz., the effects it produces upon the man's own body—is from the first to the last almost entirely under the man's control. If an ordinary individual went to a medical man for treatment, he would be asked to give an account of the circumstances which led up to the illness of which he complained. A false account might so mislead the

medical man that a wrong diagnosis, and in consequence a wrong treatment, would be the result. When we consider the innumerable difficulties with which the employer has to contend, and the numerous cases of malingering which occur, especially in connection with muscular strain and rupture, it is not reasonable that further difficulties should be put upon the employer, and that he should be called upon to defend himself without his medical man being given the same opportunities of making a complete examination as he would have given were the injured man merely a patient and not a plaintiff. A part of these reasonable opportunities undoubtedly consists in a full account of the accident. To give a simple example: A man alleges that he has strained himself in carrying a weight, and refuses to give any further information. If the medical man were informed that, owing to imperfect balance upon the man's shoulder, the burden had fallen backwards, he would expect to find the strain of a different series of muscles from those which would have been injured if the man had stumbled and fallen forward. It is impossible in many cases to be certain whether or not the symptoms arise from the accident, and whenever a workman puts forward a claim, he is always able to produce a doctor to swear that in his opinion the injuries were caused by the accident, whereas the employer's medical man is often in honesty bound to admit that there is a remote possibility of their having been caused by an accident, though he does not for a moment believe they were.

The result is that, unless a medical referee is present to control the evidence of the workman's doctor, an award is invariably made in favour of the workman.

We have known medical men give evidence, in the witness-box, which, if given in answer to a question by an examiner for a medical degree, would inevitably prevent their passing their examination.

(b) **The Verification of Symptoms.**—The primary object of the examination made by the medical expert for the employer is to ascertain whether or not the condition of which the man complains is present, and, if it is present, whether or not it was caused by the circumstances to which the man attributes it.

In many cases the answer is self-evident, but in others a very thorough examination must be made of every part and system of the body.

(c) **The Keeping of Notes.**—The medical expert for the employer is occasionally given the opportunity to examine the

patient more than once. On each occasion he should make full notes of all the patient's sayings and complaints. He should make careful measurements and sketches, which, if made at earlier and later examinations, will show any change that the patient undergoes. These notes, if made at the time of the examination, may be freely used to refresh the expert's memory when he is in the witness-box.

(d) **Diagnosis and Prognosis.**—The medical expert must exercise the utmost care in his diagnosis and prognosis, and be fully prepared for a severe cross-examination on all the reasons upon which his conclusions are based.

(e) <b>Early Reports.</b>	{	See above, (1) Duties of the Medical Expert for the Patient, under the same heads.
(f) <b>Treatment.</b>		

3. *As a Consultant who is called in to examine the Case or who has treated the Patient in a Public Hospital.*

The consultant examines the patient, and will appear in court nominally for one side or the other. He is in a relatively independent position, and can therefore easily divest his mind of bias and approach the case in a judicial spirit. In this spirit he can write his report and discuss the case with other medical men. This is his duty to his position and to the medical profession. Before he goes into court he should, if the opportunity arises at a joint consultation, use his best endeavours to bring the doctors on the two sides into agreement upon a reasonable diagnosis and prognosis capable of forming the basis of a settlement. If complete agreement cannot be realized, he should try and prevent conflicting and bewildering evidence from being given in court, in order that the jury, a body of laymen, should not be driven to ignore medical opinions and to decide a difficult medical case as best they can. It is notorious amongst medical men that gross injustices are often done when the medical evidence is conflicting. Unfortunately, except in arbitrations under the Workmen's Compensation Act, the courts hearing accident cases, which are frequently highly technical, are not assisted by medical assessors. In these circumstances the court naturally looks to the more independent and experienced medical witnesses for help. It cannot be said that the court always gets from these witnesses the desired assistance, or a demonstration that the medical is an honourable and learned profession.

## CONSULTATIONS BEFORE GOING INTO COURT.

There are two kinds of consultation which should never be omitted:

1. Joint consultation of the medical witnesses.
2. Consultation with counsel.

**1. Joint Consultation of the Medical Witnesses.**—It is most desirable that all the medical men on both sides should meet together and examine the patient in consultation. At such consultations there should be no difficulty in reaching agreement upon the results of the physical examination of the patient. Complete agreement upon the diagnosis and prognosis is frequently not arrived at, but the differences of opinion are often greatly reduced. Nothing is more lamentable or more damaging to the medical profession than for medical witnesses to differ about the simple medical facts, and to give opinions that are so at variance that it is often difficult to believe that they refer to the same patient.

When an agreement has been reached between the two medical experts as to certain facts or opinions, a note of the points upon which they agree should be made at the time by each of the men. This note should not be altered afterward, though if anything is forgotten it could be added on a separate slip of paper, which should be dated to show when it was made.

We have come across instances in which a medical man, either inadvertently or owing to the legal exigencies of the cases having demanded it, in court has not only repudiated the opinions to which he agreed, but has denied that he ever agreed to them. An unattainable ideal would be the drawing up and signing of a statement by the two medical men of the points upon which they agreed.

**2. Consultation with Counsel to his own Side.**—There is no better preparation for the doctor's evidence than for him to explain to counsel the medical points of the case, and the grounds for the opinions expressed in his reports. Further, it is essential to the witness to know beforehand the line which counsel is going to take.

## THE LEGAL OBLIGATIONS OF WITNESSES.

**1. Obedience to a Subpœna.**—A common witness must obey a subpœna or be guilty of contempt of court.

If an expert witness has never examined the patient, and

has no previous personal knowledge of the facts of a case, he is solely an expert witness, and none of his evidence is that of a common witness. It is doubtful whether even such an expert witness can neglect a subpoena without being liable for contempt of court.

Medical men are rarely summoned as purely expert witnesses, as they have generally seen the patient, or have some personal knowledge of the facts of the case, and therefore in the capacity of common witnesses must obey a subpoena.

2. **Professional Secrecy.**—This is not recognized by the law, and if a medical man refuses to answer a question in the witness-box, where he has sworn to divulge the whole truth, he is liable to be committed for contempt of court.

Questions of professional secrecy can seldom arise in accident cases, because a patient cannot expect to recover damages unless he be willing that all the medical facts about him should be known.

Should a case arise, the medical man before going into court would be wise to discuss the point with the patient and his counsel. In the majority of instances he will probably compromise his conflicting duties to his patient and to the law by entering a protest and then answering the question.

#### THE CONDUCT OF THE EXPERT WITNESS IN COURT.

An expert witness is allowed to be present in court throughout the case. He should make a point of hearing all the medical evidence before he is called. Many a case has been lost by his failure to do this. When he has finished his evidence, he should not leave without the permission of the Judge, in case the court should wish to recall him.

Many qualities not possessed by everyone are necessary to make a really good witness, especially ability to impress the court with the idea that he understands completely the medical aspects of the case, that he is not unduly biassed, and that he is perfectly candid. Other necessary qualities are the power of expressing ideas, of thinking rapidly and logically, and of keeping cool and good-tempered. Few men, however, will fail to be satisfactory witnesses if they give a little thought to the case before they go into court, and are careful to avoid some obvious pitfalls.

1. **The Giving of Evidence.**—It is of the first importance to speak slowly and distinctly, so that the Judge, jury, and



counsel can hear the evidence easily and distinctly. Nothing irritates the court and spoils evidence more than for a witness to mumble or gabble off his answers so that he has to be asked constantly to repeat them. The Judge writes down much of the evidence; and in order that the Judge can take down his words in longhand, the witness should watch him and speak slowly. The witness should not turn right round towards the examining counsel, as if his answers did not concern the Judge and jury.

It is imperative to avoid, as far as possible, all technical terms. If used, they will have to be explained, and everything which breaks the thread of the examination and wastes time should be avoided. The court sometimes understands "knee-jerks" and other "reflexes," and has a notion of organic and functional disease, but it knows nothing of most anatomical and pathological terms.

The medical witness should remember what is his proper function in a case. Unlike counsel, he is not in court on behalf of a particular individual or opinion, but he is there as an interpreter of facts, who is to assist the court to reach the truth by expressing opinions of his own and criticizing any contrary opinions which others have deduced from the same facts. He should adopt a simple and matter-of-fact style, avoiding exaggeration or any attempt at dramatic effects.

**2. Qualities of the Ideal Expert Witness.**—(a) *Knowledge.*—A witness has nobody but himself to blame if he is shown to be inaccurate about facts, or to have been careless and superficial in his medical examination of the patient. Very often the witness is subjected to a rigorous cross-examination on the opinions which he has expressed—*i.e.*, his diagnosis and prognosis. His diagnosis is his opinion of the most probable explanation of the facts; he must be prepared to give valid reasons why he considers this diagnosis the most probable, and why he considers all others which may be suggested to him less probable. Although the diagnosis given by the witness may be medically the most probable one, it is unlikely to be the only one possible. If there are other possible diagnoses, counsel is certain to suggest as an alternative one that is more favourable to his clients. While the witness gives his reasons for refusing to accept the suggested diagnosis, he must at the same time admit (if at all reasonable) its possibility. For nearly everything is possible medically, and there are no clinical

rules without exceptions. To refuse to admit this is to show oneself hopelessly biassed or ignorant.

The witness before going into court should always read over and make himself familiar with the standard English authorities and recent words of reference, and this for the following reasons :

(a) It is dangerous, unless the witness is himself a great authority, to express opinions at variance with those of standard authorities, for these are supposed to give the combined clinical experience of the medical profession. If the witness does express unorthodox opinions, he must be prepared to show that he has had such an experience as entitles him to form an independent judgment, and that, while he is familiar with the orthodox view, he can give good reasons why he does not agree with it.

(b) The opposing counsel may quote opinions in opposition to those expressed by the witness, who ought to be in a position to detect when the quotation is taken from a standard book now out of date, or from an old edition of a work in the recent edition of which different views are expressed. Also the quotation may be taken from an author who, in England at any rate, is not considered a standard authority. The quotation may be a single sentence or part of a paragraph, which taken by itself may give an erroneous idea of the author's view. For these reasons the witness should never accept a quotation which is unfamiliar to him without it being verified by himself or his counsel. (He may ask to see the book.)

A witness should not quote authorities by name unless asked to do so. If he wishes to quote the opinions of others, he must give them as if they were his own, since the opinions which he expresses in court are supposed to be the result of his own knowledge and experience.

(b) *Fairness and Candour.*—These are shown in many ways. For instance, some witnesses do not admit without obvious reluctance any fact, or assent to any conclusion, which tells against their own side. This is a great mistake.

The truth of an opinion contrary to one's own is possible on the ground that everything is possible.

Counsel often put hypothetical questions. Thus, suppose a witness has just expressed the opinion that the patient's hand will recover completely so as to enable him to perform again perfectly the skilled movements necessary for his work. Counsel may ask, "Supposing the hand does not recover, will not the

patient be permanently incapacitated from following his employment?" The right answer, of course, is, "Yes."

Some expert witnesses apparently find difficulty in giving this obvious answer; they seem to think that they would be making an admission that would weaken their position, and fail to see that the question is based in a premise the truth of which they have already denied.

If a witness does not know a fact, or does not feel in a position to express an opinion, he should say so, and having said so he should stick to it. It is always dangerous to guess, or to escape from a searching question by giving an evasive answer.

There are, however, questions asked in cross-examination which should be answered with caution and deliberation. By so doing the witness shows caution, and not want of candour. He should not answer questions the exact significance of which he does not understand. Counsel often ask involved questions, the true meaning of which may not be clear. A medical witness should be cautious about hazarding too definite opinions, and especially in complicated cases. He should beware of assenting too readily to apparently casual questions which in themselves suggest the answer which he is expected to give. Not infrequently counsel adopts and restates as a question an answer given by a witness, imparting to it at the same time a meaning different from that which the witness intended. However slight the difference in meaning may be, the witness should never allow this to pass uncorrected, because he cannot tell what subsequent use may be made of it. Occasionally counsel demand an answer of "Yes" or "No" without qualifications. The witness may be unable to give either answer without conveying a false impression. He may reply that in that form it is impossible to give a fair answer to the question. Or he may be asked a question which he considers unfair or improper. In either case, if the question is still pressed, he should appeal to the Judge, who will decide whether the witness has to answer at all, or to answer in the particular way demanded by counsel. Such appeals should be avoided if possible.

(c) *Temper.*—The general attitude and bearing of the witness is important, because of the impression it must produce on the court. Some witnesses find it difficult to remain cool and collected during a searching cross-examination. We have seen medical witnesses who have adopted a defensive attitude, and obviously resented counsel criticizing their diagnosis and treat-

ment, or attempting to show that their clinical experience has been rather limited. In fact, they seem almost to treat such criticism as a personal attack upon themselves in public. Such an attitude is absurd and ill-advised. A witness who has lost his temper is off his guard, and may be betrayed into making rash statements. Then he will have the satisfaction of knowing that he has done exactly what counsel hoped he would do. Other witnesses err in treating counsel as laymen, ignorant of medical matters. It is always wise to assume that counsel has made himself thoroughly familiar with the medical aspects of the case in question, and has consulted the standard authorities.

#### THE EXAMINATION OF THE WITNESS.

The witness, after being sworn, will undergo the following examinations :

1. Examination-in-chief.
2. Cross-examination.
3. Re-examination.

**1. Examination-in-Chief.**—This is carried on by a series of questions and answers between his own counsel and himself. The examination is based upon the report of the witness himself. It deals in the first place with the medical facts which he has observed; then he is given an opportunity of stating his general opinion of the nature of the injuries and their results, and this may be further elaborated by a series of questions.

The witness should answer counsel's questions strictly to the point, and as concisely as is consistent with expressing his exact meaning. He should not attempt to anticipate the line which he thinks counsel is pursuing by giving answers beyond the scope of the question put to him. A simple "No" or "Yes" is often sufficient. If the witness does not understand what a question means, he should say so. If he understands the question, but does not see the point to which the question is leading, he should still answer without hesitation, counsel alone being responsible for the line along which a case is developed.

The witness should therefore be careful not to anticipate the questions which he feels that counsel will soon put.

Medical facts should be reproduced with precision, and

opinions should be expressed with a familiarity and fluency which betoken thought and conviction.

The witness should have his rough notes (*i.e.*, his original notes, and not a copy of them) in his pocket, as he has always the right to refer to them to refresh his memory in the witness-box.

Sometimes the court may ask him to refer to them in order to avoid the delay caused by the witness having to think out his answers.

He should, however, be able to give accurately from memory all the details of his examination of the patient.

Though he may refer to his notes, in order to refresh his memory, without permission, he may not read them aloud, because the law requires that evidence given by a witness should be oral, and not documentary. Nothing creates a worse impression than that the witness should appear to be imperfectly acquainted with the facts of the case.

2. **Cross-examination.**—This is carried out by questions and answers between the witness and the opposing counsel. The object of the counsel is to test the witness in respect of his knowledge, fairness, candour or temper, and to see if he can find a weak place in one of these, so as to discredit the witness in the eyes of the court.

3. **Re-examination.**—If necessary, the witness is examined again by counsel on his own side, whose object is to clear up any doubtful points and to rectify any part of the evidence which has become distorted during cross-examination. Counsel may not introduce fresh subjects without the permission of the court; but if this is given, a second cross-examination on the new matter may also be permitted.

A witness at any period of his examination is liable to be asked questions by the Judge or jury.

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*For legal points and cases relating to Medical Men, Referees, and Witnesses, see MEDICO-LEGAL ASPECT OF ACCIDENT: DIAGNOSIS; and CASE GUIDE: Expert Evidence.*

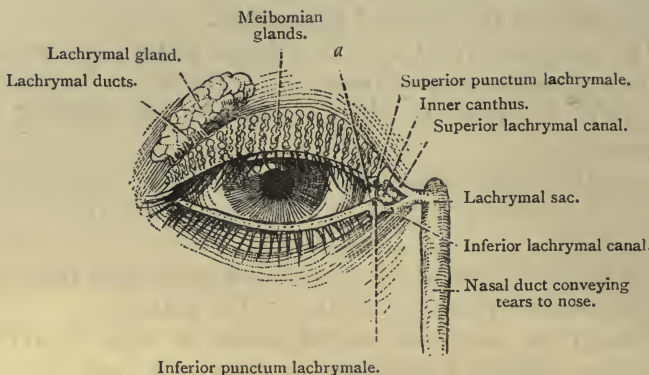


FIG. 69.—THE RIGHT EYE, WITH THE SKIN REMOVED FROM THE UPPER LID. THE TEAR GLANDS, DUCTS, AND CANAL TO THE NOSE, ARE ALL DISPLAYED.  
 (From Buchanan's "Anatomy.")

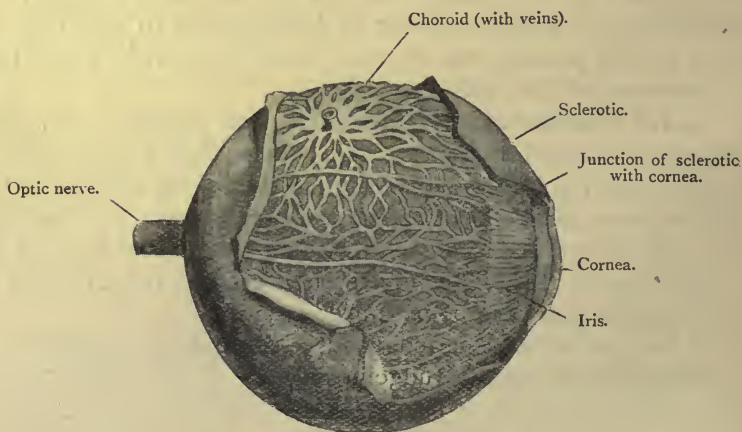


FIG. 70.—THE EYE, TWICE NATURAL SIZE.

The conjunctiva, which covered the front of the eye, is entirely removed. The sclerotic (white of the eye), or the external coat, is removed in parts. The cornea (the transparent front of the eye) is cut in section. The iris is exposed under the sclerotic. The choroid, with its numerous veins, is exposed behind the iris.

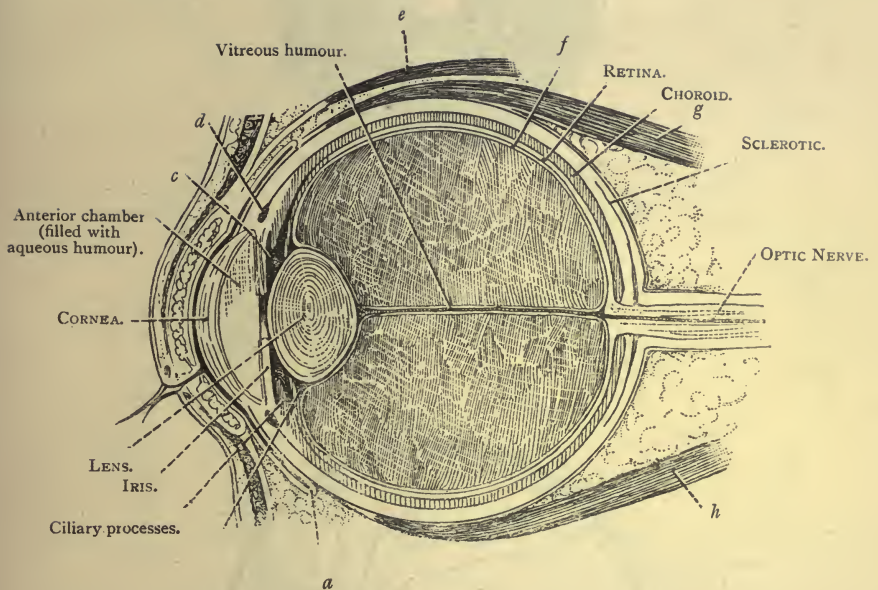


FIG. 71.—VERTICAL SECTION OF THE CLOSED HUMAN EYE, WITH THE EYELIDS, ETC., ABOUT TWO AND A HALF TIMES THE NATURAL SIZE.

The letters *a* to *h* indicate named parts.

(From Buchanan's "Anatomy.")

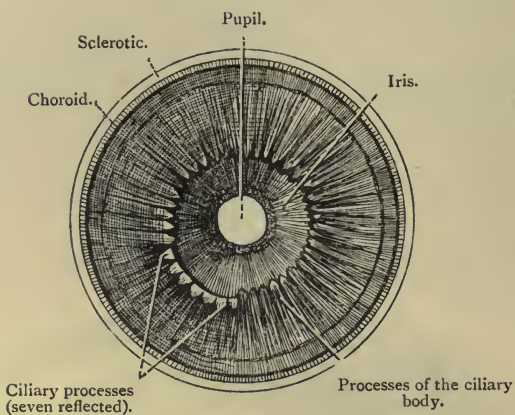


FIG. 72.—FRONT OF THE EYE, CUT OFF AND SEEN FROM BEHIND.  
 (From Buchanan's "Anatomy.")

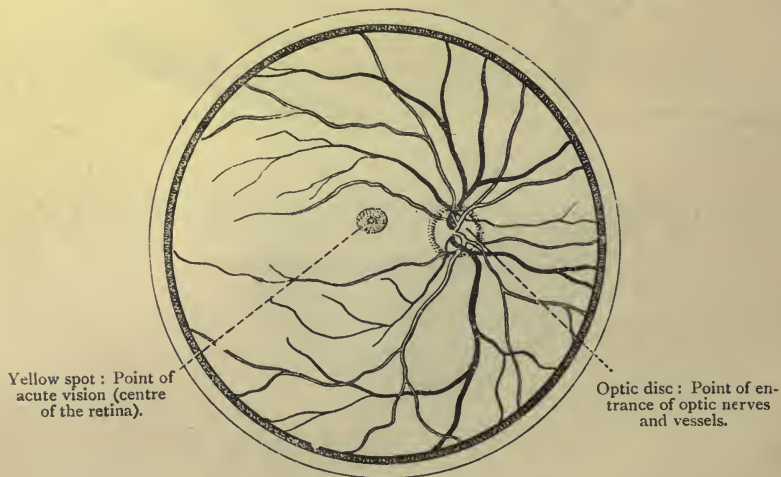


FIG. 73.—APPEARANCE PRESENTED BY THE RIGHT EYE WHEN SEEN THROUGH AN OPHTHALMOSCOPE AND MAGNIFIED.  
 (From Buchanan's "Anatomy.")



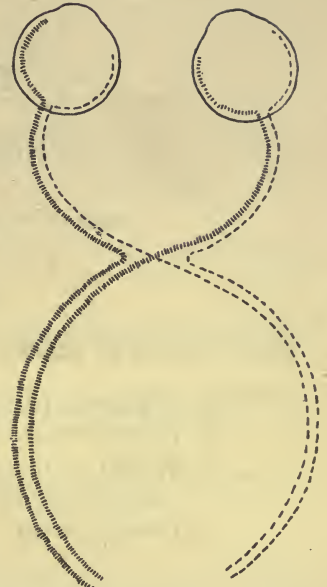
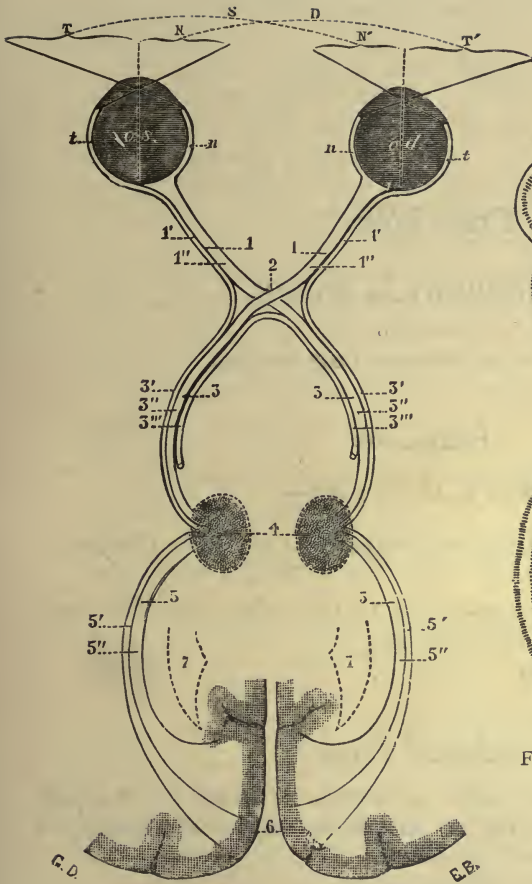


FIG. 75.—SIMPLE DIAGRAM OF FIG. 74.

FIG. 74.—SCHEME SHOWING THE PATH FOLLOWED BY IMPRESSIONS PRODUCED BY RAYS OF LIGHT FROM THE OUTSIDE WORLD, THROUGH THE RETINA, TO THE SURFACE OF THE BACK OF THE BRAIN ON EACH SIDE OF THE MIDDLE LINE.

1, 1'', Optic nerve; 2, optic commissure, or union; 3, 3'', optic tract, or fibres from the nuclei to the union (2); 4, nuclei; 5, 5'', fibres from the back of the brain to the nucleus; 6, centre for vision (for the position of which see Figs. 46, 49). It will be seen that rays of light from the direction of T and N', coming from the object situated on the left of the person, will fall at the spots on the retinas which are marked n on the left eye, and t on the right eye. From these spots the impressions will be conveyed in each case along the *right* optic tract, the fibres from the left optic nerve crossing over to the right at the commissure, or union.

(From Buchanan's "Anatomy.")

# THE EYE.\*

BY HERBERT L. EASON,

M.D., M.S.,

Senior Ophthalmic Surgeon, Guy's Hospital.

## Head-note.

THE results of an accident to the eye are—

1. Blindness, partial or complete, in one or both eyes.
2. Double vision.
3. Spread of inflammation to the other eye, the eye-socket (orbit), or brain.
4. Disfigurement.

## Technical Terms.

*Amblyōpiā*.—Indistinct vision; incomplete or *incipient* amaurosis; diminished acuteness of retinal perception, without any opacity of the cornea or of the interior of the eye.

*Anterior S̄ynēchiā*.—See below, Synechia.

*Aqueous Humour*.—That portion of the transparent contents of the eye which lies in the front chamber of the eye, between the cornea and the iris. [Fig. 71.]

*Ātrophy*.—Wasting away owing to lack of nutrition.

*Cānthus*.—The angle of junction of the eyelids. The inner canthus is that nearer to the nose; the other is called the outer canthus. [Fig. 69.]

*Cataract*.—An opacity of the crystalline lens, or of its covering (capsule), or of both. The term is suggestive of a veil falling over the eye and obscuring vision. Cataract admits of the following varieties:

\* Miner's Nystagmus and Glass-worker's Cataract are included in the third schedule of the Workmen's Compensation Act (see pp. 331, 332).

1. *Black*.—A cataract in which the lens is of a very dark brown or black colour throughout.
2. *Cortical*.—The opacity commences in streaks at the edge of the lens.
3. *Diabetic*.—Cataract occurring in diabetic patients; it is usually of the soft variety.
4. *Fluid*.—The lens is more or less converted into fluid; it occurs in young people.
5. *Glass Blowers*.—See Posterior Polar.
6. *Hard*.—The lens is harder than normal.
7. *Lamellar*.—In this variety the nucleus and superficial layers are clear, but the intermediate layers are opaque; it is most frequently found in children the subjects of infantile convulsions.
8. *Nuclear*.—The opacity commences in the nucleus of the lens; the patients are usually advanced in years.
9. *Posterior Polar, or Posterior Cortical*.—A small white opacity situated at the posterior pole of the lens. This is "glass-blower's" cataract.
10. *Primary*.—Those forms which are unassociated with any antecedent disease of the eye.
11. *Pyramidal*.—A small localized white opacity situated at the anterior pole of the lens, hence called "anterior polar cataract."
12. *Secondary*.—Those forms which result from injury (traumatic) or from disease of the eye.
13. *Zonular*.—Same as *lamellar*.

*Choroid*.—The vascular coat or tunic of the eyeball lying between the sclerotic externally and the retina internally. It is dark from the colour (pigment) it contains. [Figs. 70, 71.]

*Choroiditis*.—Inflammation of the choroid.

*Ciliary Body*.—The name of the ring which results from the union of the ciliary processes. The region of the ciliary muscle and processes is called the "ciliary region," injury to which is followed by grave results. [Figs. 71, 72.]

*Ciliary Process*.—A portion of the choroid surrounding the lens, and consisting of numerous little folds (plicæ), arranged in a radial direction. It suspends the crystalline lens in its place, forming a bond of union between the choroid, sclerotic, and iris. [Figs. 71, 72.]

*Conjunctiva*.—The moist skin (mucous membrane) which covers the cornea, the front part of the sclerotic, and, becoming red, lines the inner surface of the eyelids.

*Cornæa*.—The transparent, horny portion of the external tunic of the eye, fitting into the sclerotic as a watchglass fits into its frame. [Figs. 70, 71.]

*Cornæal Nebula*.—See below, *Nebula*.

*Dīstīchīāsīs*.—An affection in which each lid has a double row of eyelashes, some of which, inclining inward, irritate the eye.

*Ēchhymōsis*.—Small bleedings under the skin, causing a red spot. Common in the conjunctiva, on the inner surface of the eyelids, and on the eyeball.

*Ēctrōpion*.—Turning out (eversjon) of the eyelid so that it does not completely cover the globe of the eye; more common to the lower than to the upper lid. It is opposed to turning in (introversion) of the eyelids.

*Ēntropion*.—Turning in (inversion) of the margin of the eyelid, so that it comes in contact with the conjunctiva. (Compare Ectropion.)

*Glāucōma*.—An unhealthy increased stretching or tension of coats or tunics of the eyeball, produced by abnormal pressure of the fluids contained in the eyeball.

*Hæmorrhage*.—Bleeding.

*Interstitial Kērātītis*.—See below, Keratitis.

*Īris*.—Literally, a rainbow, and hence applied to the rainbow-like membrane which, with circular aperture in its centre, extends across the globe of the eye, separating the anterior from the posterior chamber. [Figs. 70, 71, 72.]

*Irītis*.—Inflammation of the iris of the eye.

*Kērātītis*.—Inflammation of the cornea.

*Kērātītis, Interior, or Chronic Interstitial Kērātītis*.—Inflammation of the layers of the cornea the result of congenital syphilis.

*Lāchrýmal Sac*.—The receptacle for the tears, an oval bag situated near the inner angle of the eye. It constitutes the upper extremity of the tear-duct to the nose (the nasal duct). [Fig. 69.]

*Lens*.—Properly, a small roundish glass shaped like a lentil or bean. The term is applied to the crystalline body situated behind the transparent cornea of the eye, for concentrating the rays of light to a focus on the retina.

*Nebūla*.—A cloud. Haziness or dulness; a slight form of opacity of the cornea.

*Neurītis, Optic*.—See Optic Neuritis.

*Ōphthālmōscōpe*.—An instrument for viewing the interior of the eye.

*Orbit*.—The bony cavity or socket wherein the eye is set.

*Optic Ātrōphhý*.—Gradual wasting of the optic nerve. (Atrophy, a want of nutrition.)

*Optic Nerve*.—This nerve, the root of which is within the brain, leaves the skull by a hole at the back of the socket, and enters the back of the globe of the eye, not quite in the middle, but on the inner or nasal side of the centre. [Figs. 43, 54, 70, 71, 73, 74.]

*Optic Neurītis*.—Inflammation of the optic nerve; one of the signs of inflammation of the brain. It is seen by the ophthalmoscope in the optic disc. [Fig. 73.]

*Phlyctænūla*.—A small “phlyctæna.” A small bleb (vesicle) found on the conjunctiva near the margin of the cornea.

*Pīngūecūla*.—A small yellow nodule found in the conjunctiva close to the inner or outer margin of the cornea in elderly persons; it consists of thickened conjunctiva and subconjunctival tissue, and contains no fat.

*Prolapse of the Īris*.—Protrusion of the iris through an ulcer or wound of the cornea or sclerotic.

*Ptōsis*.—A falling of the upper eyelid, with a partial or complete want of power to elevate it, caused by paralysis of the nerve of its muscle.

*Pūntā Lācṛyṃālia*.—The commencement of the tear (lachrymal) ducts, situated on the lachrymal tubercles near the inner corner (canthus) of the eyelids. [Fig. 69.]

*Pupil*.—The round aperture in the centre of the iris of the eye, through which the black interior of the eye is seen. [Fig. 72.]

*Retīna*.—The transparent, colourless, net-like expansion of the optic nerve on the inner surface of the eye. The images of the objects through the lens, being as it were painted on the retina, are conveyed to the common sensorium of the brain, where the mind views and contemplates them. [Fig. 71, 73.]

*Retīnītis*.—Inflammation of the retina.

*Sclērōtic*.—The dense fibrous membrane forming the outer covering, and constituting the white of the eye. [Figs. 70, 71, 72.]

*Syṃblēphāron*.—A partial or entire adhesion of either eyelid to the eyeball.

*Sympathetic Ōphthālmīa*.—Inflammation of the sound eye arising secondarily from disease in the other.

*Syṅechīa*.—Literally, an adhesion. The adhesion of the iris to the capsule or covering of the crystalline lens is called “synechia posterior”; that of the iris to the cornea is called “synechia anterior.”

*Trīchīāsīs*.—A disease of the eyelids, in which they are turned in (introversion), so that the lashes irritate the eye. It is opposed to ectropion, or the turning outwards (eversion) of the eyelids.

*Vitrēous Humour*.—The jelly-like, transparent material which fills the greater part of the interior of the eye behind the lens. [Fig. 71.]

### Anatomy.

The orbit or eye-socket, containing the eye, is in shape roughly pyramidal, with its base forwards. Its walls are bony on all sides with the exception of a few apertures for the passage of bloodvessels and nerves. The roof of the orbit, separating that cavity from the brain, is very thin and liable to penetration.

The socket contains fat, the eyeballs, those muscles which

control the movement of the globe, besides arteries, veins, nerves, and lymphatic vessels.

The globe of the eye consists of two parts—anterior and posterior; the larger posterior part is roughly circular, and is covered by a white fibrous tunic, termed the “sclerotic coat.” The anterior part, which is a small segment of a circle of smaller radius, is transparent, and is termed the “cornea.” These two portions of the globe are separated internally by a thin diaphragm, the iris, which is perforated by a circular aperture, the pupil. [Figs. 70, 71, 72.]

The cavity between the cornea and the iris is filled with fluid, the aqueous humour. Immediately behind the pupil is the transparent crystalline lens of the eye, suspended in a thin capsule attached by numerous strands to a ring of glandular and muscular projections, which spring from the back of the circumference of the iris. These glandular and muscular projections are termed the “ciliary process of the ciliary body.” [Figs. 71, 72.]

The posterior part of the globe of the eye is enclosed by three tunics: an external white fibrous coat, tough and resistant (the sclerotic); a middle or vascular coat, composed principally of bloodvessels in a fine state of subdivision (the choroid); an inner membrane (the retina), the organ of vision, which is a fine prolongation of the optic nerve, is of a complicated structure, and in close contact with the choroid, but attached only in one or two places. [Figs. 71, 72.]

The back of the cavity of the eye is filled with a transparent, jelly-like substance of firm consistency—the vitreous humour. [Fig. 71.]

The optic nerve enters the eyeball behind, near the middle; its length is about  $\frac{3}{4}$  inch.

The eyeball and the contents of the socket are protected by the eyelids, which move freely over the eyeball. The eyeball and the eyelids are separated by a lining membrane termed the “conjunctiva.”

**Lachrymal Apparatus.**—The tears are secreted by a small almond-shaped gland (the lachrymal gland) situated beneath the upper and outer margin of the socket. The tears are carried away from the eye through two minute holes (the *puncta lacrymalia*) situated at the inner end of both lids. These holes open into two fine canals (the lachrymal canaliculi). These in turn open into a sac which rests in the concavity of the lachrymal bone. From this sac the lachrymal duct, in diameter

about that of a crow-quill, leads downwards and opens into the cavity of the nose. [Fig. 69.]

### Consequences of Accident.

The following are the injuries to the eye and their sites :

1. **Eyelids.**—(i.) Contusions, bruises (black-eye); (ii.) lacerations, incisions or cuts; (iii.) burns.

2. **Conjunctiva** (the skin lining the eyelids and covering the eyeball).—(i.) Foreign bodies; (ii.) lacerations; (iii.) burns.

3. **Cornea** (the clear part of the eye).—(i.) Foreign bodies; (ii.) abrasions; (iii.) ulcers; (iv.) burns; (v.) perforating wounds.

4. **Sclerotic** (the white of the eye).—(i.) Rupture; (ii.) perforating wounds.

5. **Iris** (the coloured part of the eye).—(i.) Foreign bodies; (ii.) incised wounds. The result of blows upon the eye: (iii.) Iridodialysis; (iv.) retroflexion or inversion; (v.) rupture of the pupil; (vi.) traumatic aniridia.

6. **Ciliary Body.**—(i.) Foreign bodies; (ii.) perforating wounds.

7. **Choroid.**—(i.) Foreign bodies; (ii.) perforating wounds; (iii.) rupture of the choroid; (iv.) extravasation of blood from blows.

8. **Lens.**—(i.) Foreign bodies; (ii.) traumatic cataract; (iii.) dislocation of the lens.

9. **Vitreous.**—(i.) Foreign bodies; (ii.) hæmorrhage.

10. **Retina.**—(i.) Foreign bodies; (ii.) hæmorrhage; (iii.) blindness due to exposure to excessive light; (iv.) detachment of the retina; (v.) traumatic œdema.

11. **Optic Nerves.**—(i.) Laceration; (ii.) compression.

12. **Orbit (Eye-socket).**—(i.) Foreign bodies; (ii.) perforating wounds.

13. **Muscles.**—Paralysis.

14. **Lachrymal Apparatus** (tear-secreting and draining apparatus).—(i.) Injury to the lachrymal gland; (ii.) injury to the lachrymal ducts.

1. **Eyelids.**—(i.) Contusions, bruises (black-eye); (ii.) lacerations, incisions or cuts; (iii.) burns.

(i.) *Contusions.*—The eyelids may be injured by bruises (contusions), burns, or lacerations. Bruises (or black-eye) cause merely temporary discoloration, which disappears under the simplest treatment. Bruises may be associated with other effects of blows on the eye. (See below.) Either a black-eye or a subconjunctival hæmorrhage may result from injuries to

the nose or from fractures to the anterior part of the base of the skull.

(ii.) *Lacerations, Incisions, or Cuts.*—The same remarks apply to lacerations, incisions, or cuts, except that laceration of the eyelids on their inner side may result in injury to the lachrymal ducts and chronic overflow of tears.

(iii.) *Burns.*—Whether from fire or corrosives, burns may lead to adhesion of the lids to the eye, and cause loss of mobility or loss of protection; inversion or eversion of the lids may also result. The permanent injury is usually rather a disfigurement than a visual defect, though the latter may occur as the result of exposure of the cornea, producing irritation and ulceration of its exposed surface, or by ingrowing eyelashes.

2. **Conjunctiva.**—(i.) Foreign bodies; (ii.) lacerations; (iii.) burns.

(i.) *Foreign Bodies.*—Foreign bodies may lodge under the eyelids; they are usually easily removed, and the injury is negligible. Foreign bodies on the conjunctiva can be easily removed under cocaine without producing permanent injury.

(ii.) *Laceration.*—Slight lacerations of the conjunctiva are of small importance, and heal with the simplest treatment; they may be associated with bleeding under the conjunctiva (ecchymosis), which requires no treatment. Some lacerations of the conjunctiva, especially if extensive or involving opposing surfaces of the membrane, may lead to adhesions between the lids and the eyeball. These adhesions may cause limitation of the ocular movements or serious defect of vision.

(iii.) *Burns.*—Burns, if slight, may cause little or no permanent injury; if severe they may cause union of the lids and eyeball and contraction of the lids, resulting in inversion of the lids (entropion), which may lead to a turning inwards of the lashes (trichiasis), producing ulceration of the cornea and loss of vision. In severe cases the corneal ulceration may lead to inflammatory destruction of the whole eyeball.

3. **Cornea** [Figs. 70, 71].—(i.) Foreign bodies; (ii.) abrasions; (iii.) ulcers; (iv.) burns; (v.) perforating wounds.

(i.) *Foreign Bodies.*—These are usually metallic particles which lodge on the cornea, and, if unskillfully removed or allowed to remain, may cause ulcers of the cornea, corneal opacities, inflammation of the iris (iritis), formation of matter (pus) in the anterior chamber of the eye, or serious inflammation of the eye. They can usually be removed without much damage to vision; but if ulceration is allowed to begin, more



or less opacity may result. The after-effect of ulcers is discussed below.

(ii.) *Abrasions*.—Abrasions of the cornea may follow slight injuries; they clear up rapidly as a rule unless subsequently infected, and leave only a very slight scar.

(iii.) *Ulcers of the Cornea*.—These may result from foreign bodies, abrasions, or burns, from infection of the cornea by bacteria, or from disturbances of nutrition.

(iv.) *Burns*.—Burns of the cornea will produce greater or less ulceration, according to the severity of the original injury. The consequences, both immediate and remote, are similar to those of ulcers due to other causes.

(v.) *Perforating Wounds of the Cornea*.—These are usually serious injuries. They may be small or they may extend right across the cornea, and be associated with the falling out of the iris (prolapse of the iris), which becomes subsequently adherent to the wound. Cataract, inflammation of the iris (iritis), destruction of the entire eyeball through matter forming, may all follow perforating wounds of the cornea.

The most remote effects may be total blindness of the injured eye, the result of inflammation coming on after, with the formation of matter. Inflammation may incite sympathetic ophthalmia in the other eye.

4. *Sclerotic* (white of the eye) [Figs. 70, 71, 72].—(i.) Rupture; (ii.) perforating wounds.

(i.) *Rupture*.—A rupture of the sclerotic is usually due to a direct blow, and is associated with such disorganization of the rest of the eye that in most cases it eventually has to be removed by operation.

(ii.) *Perforating Wounds*.—The same may be said of perforating wounds unless of very small extent or done with a clean instrument.

The possible consequences of such wounds of the sclerotic are: Bleeding into the fluids of the eye; formation of matter (suppuration), and inflammation of the other eye (sympathetic ophthalmia).

5. *Iris* (the coloured part of the eye) [Figs. 70, 71, 72].—(i.) Foreign bodies; (ii.) incised wounds. The result of blows: (iii.) Irido-dialysis; (iv.) retroflexion or inversion of the iris; (v.) rupture of the pupillary edge of the iris; (vi.) traumatic aniridia.

(i.) *Foreign Bodies*.—Foreign bodies are usually of small size, such as splinters of steel and iron, and may be lodged in the

substance of the iris after penetration of the cornea. They can often be removed from the anterior chamber, if they are of iron, by an electro-magnet; but if firmly embedded in the substance of the iris it may be necessary to remove a small part of the iris at the same time. (See below, Operation.)

(ii.) *Incised Wounds*.—The iris is often implicated in penetrating wounds of the cornea or sclerotic, and this injury is usually associated with injuries of the lens or of the ciliary body.

Simple incised wounds of the iris are usually of trivial importance (unless they become infected), and, though associated with more or less bleeding into the anterior chamber, clear up rapidly under simple treatment without operation. More severe injuries of the iris when associated with prolapse of the iris may require immediate operation for replacement of the prolapse. This operation is not unattended with risk, and in severe cases, or in those which have become infected, it may be necessary to remove the eye to prevent sympathetic ophthalmia. In any case, the defect of vision is usually considerable.

*Blows on the Eye*.—The following injuries of the iris may be caused, without external wound, by blows on the eye:

(iii.) *Irido-Dialysis*.—Separation of the iris from its attachment to the eye (ciliary body). The vision is usually but slightly affected; the condition is not progressive, and does not lead to further mischief.

(iv.) *Retroflexion or Inversion of the Iris*.—The whole or a portion of the iris is folded back on the eye on the ciliary processes, giving the appearance of a dilated pupil. It is commonly associated with dislocation of the lens. It is incurable, but the vision is very often but slightly affected.

(v.) *Rupture of the Pupillary Edge of the Iris*.—This is comparatively rare. It is incurable, and leads to some considerable visual defect owing to permanent dilatation of the pupil.

(vi.) *Traumatic Aniridia*.—The whole iris may be torn off from its attachments, and lie loose in the anterior chamber, which is filled with blood. The vitreous humour in the posterior chamber also may be infiltrated with blood. The bleeding usually clears up; but the condition is incurable, and leads to considerable defect of vision.

Injuries to the iris as the result of blows are usually not inflammatory and not progressive. Any symptoms of iritis, cyclitis, or choroiditis, are therefore, in the great majority of cases, to be considered as unconnected with any such injury, but are evidence of previous or concurrent disease.

6. **Ciliary Body** [Figs. 71, 72].—(i.) Foreign bodies; (ii.) perforating wounds.

Foreign bodies and perforating wounds of the ciliary body resemble in their immediate and remote effects the corresponding affections of the iris (see above). They are as a rule more severe, more likely to lead to the necessity for the removal of the eye, and, even if curable, to cause graver defects of vision.

7. **Choroid** [Figs. 71, 72].—(i.) Foreign bodies; (ii.) perforating wounds; (iii.) rupture of the choroid; (iv.) extravasation of blood from blows.

(i.) *Foreign Bodies*.—Small foreign bodies, such as pieces of steel, iron, or flint, may perforate the eyeball and lodge in the choroid. Steel or iron bodies may be removed by a powerful electro-magnet; but if the foreign body cannot be thus extracted, the eyeball should be removed to prevent sympathetic ophthalmia.

(ii.) Perforating wounds of the sclerotic are usually associated with similar injuries of the choroid. The consequences and treatment of such injuries are the same as those of the sclerotic. (See above.)

(iii.) *Rupture of the Choroid*.—Rupture of the choroid is usually caused by blows upon the front of the eye without external wounds. It is a slit or rent in the membrane, usually at the posterior part (pole) of the eye, in the neighbourhood of the portion of the retina associated with acute central vision. The injury is therefore severe, though non-progressive, and it is not followed by other ocular affections.

(iv.) *Extravasation of Blood as the Result of Blows*.—Blood may be poured out into the choroid as the result of blows. It usually clears up, though in severe cases some fibrous blood-clot may remain, associated with defective vision.

8. **The Lens** [Fig. 71].—(i.) Foreign bodies; (ii.) traumatic cataract; (iii.) glass-blower's cataract; (iv.) dislocation of the lens.

(i.) *Foreign Bodies*.—Small foreign bodies entering the eye may lodge in the lens, usually causing traumatic cataract. If the foreign body be metallic, it may be removed by means of a powerful electro-magnet, or may be extracted along with the traumatic cataract. For the effect upon the vision of possible complications, see below, Traumatic Cataract.

(ii.) *Traumatic Cataract*.—All punctured wounds of the cornea, or anterior part of the sclerotic, may be associated with a traumatic cataract, which is caused by the puncture or laceration of the capsule of the lens. The onset of the cataract is

rapid, and leads to complete opacity of the lens in a few days. If the punctured wound is clean, the injury may be limited to the cataract, but many cases are complicated by iritis, glaucoma, or formation of matter in the eyeball. Blows on the eye, without external wound, such as those caused by a cricket-ball or closed fist, may cause a rupture of the suspensory ligament or capsule of the lens, and may also lead to traumatic cataract. (See below, Disease.)

(iii.) *Glass-blower's Cataract*.—See below, Occupation Diseases.

(iv.) *Dislocation of the Lens*.—Slight dislocations of the lens, uncomplicated by cataract or by other consequences of blows on the eye, may cause little or no defect of vision, but in severe cases vision may be greatly affected. A dislocation of the lens is liable to lead to secondary glaucoma and ultimate loss of sight.

9. **The Vitreous** [Fig. 71].—(i.) Foreign bodies; (ii.) hæmorrhage.

(i.) *Foreign Bodies*.—Foreign bodies of metal, wood, or stone, may penetrate the eyeball and lodge in the vitreous (the substance behind the lens). In all cases the injury is severe and the vision very much diminished.

(ii.) Hæmorrhage into the vitreous may be caused by blows on the eye or punctured wounds.

10. **The Retina** [Figs. 71, 73].—(i.) Foreign bodies; (ii.) hæmorrhage; (iii.) blindness due to exposure to excessive light; (iv.) detachment of the retina; (v.) traumatic œdema.

(i.) *Foreign Bodies*.—See Foreign Bodies in the Choroid.

(ii.) *Hæmorrhages* may occur in the retina as the result of blows or other injuries to the eye. They are, however, as in the case of hæmorrhages in the vitreous, common in general diseases, such as Bright's disease, diabetes, etc. There is practically no treatment for these conditions; in most cases the effects upon the vision is very slight, though extensive hæmorrhages may cause permanent failure of the vision. In certain cases of retinal hæmorrhages patients have red vision.

(iii.) *Blindness due to Excessive Light: Snow, Sun, or Furnace Blindness; Electric Ophthalmia*.—Partial or complete blindness, with little or no obvious ocular defect, may result from over-exposure to direct light from large areas of sunlit snow, from direct vision of the sun, from an arc lamp or a white-hot furnace. The visual defect is very severe, and as a rule permanent. There is no recognized mode of treatment.

(iv.) *Detachment of the Retina*.—The retina may be detached

from the other tunics or coats of the eye as the result of a blow. The ensuing defect of vision is usually very great, and complete blindness ultimately supervenes in most cases.

(v.) *Traumatic Œdema of the Retina*.—This may follow blows on the eye, and is always associated with partial or complete loss of vision. Treatment is simple, and as a rule vision is recovered in the course of a day or two.

11. **The Optic Nerve** [Figs. 43, 54, 70, 71, 73, 74].—(i.) Laceration; (ii.) compression.

(i.) *Laceration*.—The optic nerve may be lacerated by punctured wounds or by fractures of the anterior part of the base of the skull. Vision is usually totally and irremediably destroyed. The injury is followed by atrophy of the optic nerve, but by no further consequences.

(ii.) *Compression*.—The optic nerve may also be compressed as the result of fractures of the base of the skull, or from inflammatory distension of the air-spaces (sinuses) connected with the nose, in consequence of nasal trouble. (See Nose, p. 593.) This may sometimes be caused by inflammations succeeding operation on the nose, etc.

12. **The Orbit—Eye-socket** (the bony cavity wherein the eye is set).—(i.) Foreign bodies; (ii.) perforating wounds.

(i.) *Foreign Bodies*.—Foreign bodies, such as pieces of steel or stone, may lodge in the orbit. Their presence can usually be detected by means of the X rays, and in many cases they can be removed by operation. The vision of the eye is often not affected, but its mobility may be much impaired, causing double vision and inability to get about or to work. The more remote effects may be the same as those of punctured wounds.

(ii.) *Perforating Wounds*.—The orbit may be injured by perforating or punctured wounds. These may give rise to injury to the brain, as the roof of the orbit is very thin; hæmorrhages in the orbit, with protrusion of the eyeball; and injury to the muscles of the eye. Should such injuries become infected, they may be followed by erysipelas or inflammation of the tissues of the orbit, with the formation of matter, clotting (thrombosis) of veins in the skull, inflammation of the coverings of the brain (meningitis), and death.

13. **Muscles**.—Paralysis. [Fig. 71.]

The muscles of the eye may be partially or completely paralyzed as the result of injuries to the orbit; but it is to be remembered that such paralysis is very common in the later stages of acquired syphilis, as well as in tumours of the brain,

meningitis, and Bright's disease. The effect of an ocular paralysis upon useful vision is usually very great. Double vision results, which is most worrying and incurable either by operation or by mechanical appliances.

14. **The Lachrymal Apparatus** [Fig. 69].—(i.) Lachrymal gland; (ii.) lachrymal ducts.

(i.) *Lachrymal Gland*.—The lachrymal gland may be affected in perforating wounds of the orbit. As a rule the injury is very slight, though total destruction of the lachrymal gland may lead to desiccation through lack of tears, and to consequent destruction of the eyeball.

(ii.) *Lachrymal Ducts*.—Injuries to the inner part of the face and eyelids may lead to destruction of the upper part of the lachrymal ducts, and cause chronic overflow of tears. They may also ultimately lead to abscess of the lachrymal sac, to corneal ulcer, and to destruction of the eyeball from infection with matter (pus). The same condition may occur as the result of blocking of the lower part of the lachrymal duct as the result of either injury or disease of the nasal bones.

### Disease.

(1) **Caused by the Accident**.—(a) *In the Parts directly affected by the Consequence of the Accident*.

1. **Eyelids**.—Unless as the result of subsequent infection, injuries to the eyelids are very rarely affected by disease.

As the result of injuries to the eyelids the eye may be imperfectly protected, and be destroyed by ulceration of the cornea and suppuration of the eyeball.

Infected wounds may cause erysipelas and inflammation, with the formation of matter in the surrounding tissues.

2. **Conjunctiva**.—The contractions above mentioned, with the consequent inverted lashes, are the only forms of disease likely to arise from injury to the conjunctiva.

Burns are not followed by any secondary disease.

3. **Cornea** [Figs. 70, 71].—Injuries to the cornea may in rare cases start attacks of inflammation of the cornea, to which the patient is liable as the result of constitutional or hereditary taint—*e.g.*, syphilis, gout, or tubercle. This occurrence is, however, very unlikely.

As has been mentioned above, ulcers of the cornea, perforating wounds, and burns, may be followed by prolapse of the iris, cataract, iritis, and subsequent destruction of the eye by

the formation of matter or by sympathetic ophthalmia of the other eye.

Blows on the cornea are not, as a rule, followed by disease.

All ulcers, abrasions, burns, or wounds of the cornea are followed by opacities of greater or less density or extent.

The permanent defect of vision varies with the density of the opacity and its situation. Opacities in front of the pupil cause greater loss of vision than those at the side, and a widespread faint opacity may often cause greater defect of vision than a localized scar of greater density.

In perforating wounds of the cornea, involving the iris, sympathetic ophthalmia may occur. Inflammation causing matter (suppuration) does not, as a rule, cause sympathetic ophthalmia. This usually follows those cases of injury in which the iris becomes adherent to the cornea, with subsequent inflammation (iritis). It can, as a rule, be prevented by removing the injured eye not later than three weeks after the injury, if the eye still shows signs of active inflammation.

In most cases sympathetic ophthalmia is caused by improper treatment or undue delay in removing the injured eye, from a desire to save it.

Sympathetic ophthalmia may arise in the sound eye years after the injury to the other eye, and although it can be prevented by the timely removal of the injured eye, once the sound eye is affected this procedure is useless, and, indeed, inadvisable, as it sometimes happens that the injured eye turns out the better of the two.

4. **Sclerotic** [Figs. 70, 71, 72].—Wounds and ruptures of the sclerotic are frequently followed by internal inflammation and destruction of the eye, or by sympathetic ophthalmia and consequent blindness of the other. The latter condition can be prevented by the timely removal of the injured eye.

5. **Iris.** 6. **Ciliary Body.** 7. **Choroid.**—All injuries of these three regions may be followed by total destruction of the eyeball or by sympathetic ophthalmia, and may also act as stimuli to the outbreak of disease to which the patient is predisposed either constitutionally or hereditarily—*e.g.*, syphilis, gout, rheumatism, gonorrhœa, tubercle.

8. **Lens: Traumatic Cataract.**—If the punctured wound be clean, the injury may be limited to cataract, but many cases are complicated by iritis, glaucoma, or suppuration of the eyeball.

9. **Glass - blower's Cataract.** — See below, Occupation Diseases.

10. **Vitreous Humour.** 11. **Retina.**—Injuries of both these regions may be followed by destruction of the eyeball, with or without affection of the other eye.

12. **Optic Nerve.** 13. **Orbit.** 14. **Muscles.**—Injuries to the optic nerve, orbit, and muscles, are not followed by disease except as the result of infection, in which case they may be followed by erysipelas or inflammation of the tissues of the orbit, with formation of matter, by clotting (thrombosis) of the veins of the skull, by meningitis, and death.

15. **Lachrymal Apparatus** [Fig. 69].—Lacerations of the inner part of the face and eyelids may lead to destruction of the upper part of the lachrymal ducts, and cause chronic overflow of tears. They may also ultimately lead to abscess of the lachrymal sac, corneal ulcer, and destruction of the eyeball and the formation of matter.

In cases of injury to the lachrymal apparatus, where obstruction to the passage of tears is followed by abscess or inflammation, the bones of the nose or face may become diseased.

(2) **Existing before the Accident and aggravating its Effects.**—See above, Disease, (1) Caused by the Accident.

### Operation.

1. **Eyelids.** 2. **Conjunctiva.**—Most cases of adhesion of the eyelids to the eyeball, or inversion of the lashes, can be to a great extent cured by simple operations attended with little or no risk.

3. **Cornea** [Figs. 70, 71].—Defective vision in some cases of central corneal opacity may be improved by operation, which is attended with but slight risk.

The injury caused by perforating wounds of the cornea can in many cases be minimized by immediate operation for the removal of the iris, which falls out through the wound (the prolapsed iris), or for the removal of the lens on account of the cataract caused by the injury (traumatic cataract).

A delay of twenty-four hours may often result in the total loss of an eye which could have been saved by earlier treatment. The operations, however, are all severe, and attended by considerable risks.

In extensive perforating wounds of the cornea it is almost always necessary to remove the eye.



4. **Sclerotic** [Figs. 70, 71, 72].—The whole eye may have to be removed in the case of severe injury, to prevent the spread of inflammation and sympathetic ophthalmia.

5. **Iris** [Figs. 70, 71, 72].—In serious injuries to the iris, particularly when associated with prolapse and adhesion to the wound, it may be necessary to remove the part prolapsed. If the wound inflame, it may be necessary to remove the whole eye to prevent sympathetic ophthalmia.

Injuries to the iris unaccompanied by an external wound are as a rule uncomplicated, and best left alone.

Foreign bodies, if steel or iron, can usually be removed by an electro-magnet, but if firmly embedded in the substance of the iris it may be necessary to remove a small piece of the iris at the same time. Foreign bodies should always be removed without delay, as their presence may give rise to inflammation of the iris (iritis) or sympathetic ophthalmia.

6. **Ciliary Body** [Figs. 71, 72].—The remarks on the iris apply in the case of the ciliary body, except that the injury is usually more severe, and more likely to require the removal of the eye.

7. **Choroid**.—See Ciliary Body and Iris.

8. **Lens** [Fig. 71].—In a simple, uncomplicated cataract the diseased lens may become entirely absorbed without operative treatment, and though the eye is then without a lens, by the aid of suitable glasses the vision may be good. Some cataracts, however, do not absorb, and so require operation, which must be considered as severe but not of very serious risk. Cataracts complicated with injuries or inflammation of the iris are usually difficult to treat successfully, and in many cases ultimately require the removal of the eyeball. Traumatic cataract may occur as the result of a blow on the eye without external wound. These cases as a rule do not absorb if left alone, and require operative treatment. They are often complicated by dislocation of the lens. (See above.) For Glass-Blower's Cataract, see below, Occupation Diseases.

It is to be remembered that the operation for the removal of a cataractous and *dislocated* lens is attended with grave risk to the eye.

9. **Vitreous: Foreign Bodies in the Vitreous**.—Foreign bodies, if of iron or steel, may possibly be removed by means of a powerful electro-magnet, but otherwise the eyeball in most cases must be removed, for fear of inflammation and subsequent sympathetic ophthalmia. [Fig. 71.]

10. **Retina : Hæmorrhage of the Retina ; Detachment of the Retina ; Blindness due to Exposure to Light.**—An operation is not likely to do any good in these cases.

11. **Optic Nerve : Compression of the Optic Nerve.**—If a collection of matter forming in the air-spaces connected with the nose is the cause of the compression, vision may be restored by prompt operation for the evacuation of the matter. (See Nose.) In compression from other causes operation is usually unsuccessful.

12. **Orbit (Eye-socket).**—No operation is as a rule advisable for injuries to the orbit, except with the aim of removing an embedded foreign body.

13. **Ocular Paralysis.**—The effect of ocular paralysis upon useful vision is usually very great. The resultant double vision is most worrying, and is incurable by operation or mechanical appliances.

14. **Lachrymal Apparatus.**—Chronic overflow of tears may in some cases be wholly or partially cured by operation for the removal of the obstruction. Speaking generally, however, the operative treatment of lachrymal obstruction is not entirely satisfactory, and complete cures are rare.

### Cure.

1. **Eyelids.**—The injury is usually cured in two or three weeks.

2. **Conjunctiva.**—The treatment of conjunctivitis or ophthalmia in general is simple, and requires no operative measures. In most cases it leads to no permanent defect of vision, and in mild cases can usually be cured in a week or two.

Severe cases of conjunctivitis are as a rule of an infectious nature. They are not the result of particular trades or occupations, but are due to a microbe. The gonococcus is a frequent cause, especially in new-born children, of a particularly dangerous form of conjunctivitis (ophthalmia neonatorum).

**Injuries to the Conjunctiva followed by Contractions.**—The rapidity of cure depends on the success of the operation and on the preliminary treatment. Some cases of contraction of the conjunctiva due to burns or injuries are of necessarily long duration, as no operation can be undertaken until the contraction has ceased to progress. After the operation a week or two is sufficient for a cure.

3. **Cornea.**—In simple cases of ulcer, treatment is usually required for a week or a fortnight. Severe cases may be much longer under treatment, taking any time up to two or three months.

Wounds of the cornea, especially if complicated by adhesion or prolapse of the iris, may be of long duration, the time depending upon the success of the operative or other treatment.

4. **Sclerotic.** 5. **Iris.** 6. **Ciliary Body.** 7. **Choroid.**—Wounds of any of these four regions may require some time in being cured. Generally speaking, two months may be taken as the usual limit. If after the accident the eye is not free from inflammation, at the end of three or four weeks it should be removed. The operation should be followed by a further period of two or three weeks for complete recovery. If the eye progresses favourably, it should be cured by the end of four or five weeks.

Cases of injury to the iris, ciliary body, or choroid, without external wound, are usually cured in two or three weeks.

In speaking of cure, it is important to remember that by "cure" is meant cessation of inflammatory symptoms and closure of wounds.

The sight may not reach its fullest stage of improvement until months after the accident, and in the great majority of cases a serious defect of vision remains.

8. **Lens: Traumatic Cataract.**—If an operation be not required, the lens may take any time from one to six months, or even longer, completely to absorb. After the operation for the removal of a cataract, the patient is certainly not fit to return to work for six weeks, and if the work is laborious, or involves much weight-lifting or strain, not for a considerably longer period.

The question as to how far an operation for cataract may successfully restore a patient's vision is one of the greatest importance, and requires some discussion in further detail.

Vision is usually the result of the efforts of the two eyes working accurately together, controlled by a perfectly balanced muscular apparatus for appropriate synchronous movement, and associated with an equally well-balanced intra-ocular mechanism for focussing the two eyes to the same extent at the same moment.

All estimation of size, space, and distance (stereoscopic vision), is the result of two slightly different images obtained by the two eyes from their slightly different standpoint.

In the case of a person who has had a cataract removed, the focussing power of the affected eye is lost, and owing to certain optical defects of cataract glasses he is unable any longer to use his two eyes *together*, though they may each individually be very good. A man who has had a cataract extracted (even though with a suitable glass his vision reaches normal standards) has lost, therefore, a great deal of his visual capacity, and his eyesight may be said to be injured to the extent of about 30 per cent.

If, as is the case in many operations for cataract, the vision of the injured eye cannot be brought up to the normal, the injury to complete binocular vision will be correspondingly greater.

9. **Vitreous: Foreign Bodies in the Vitreous.**—In all cases the injury is severe, and the vision may be very much diminished.

**Hæmorrhage into the Vitreous.**—If this be slight, the condition usually clears up with very little permanent effect upon the vision; if severe, the vision may never be recovered.

10. **Retina: Traumatic Œdema of the Retina.**—Treatment is simple, and as a rule vision is recovered in a day or two.

Nearly all other retinal injuries are incurable.

11. **Optic Nerve.**—Most injuries to the optic nerve are incurable.

12. **Orbit.**—Injuries to the orbit, uncomplicated by infection, are usually cured in two or three weeks.

13. **Muscles.**—Injuries to the orbital muscles are usually incurable.

14. **Lachrymal Apparatus.**—The curative treatment of cases of lachrymal obstruction is long and tedious, usually lasting for months.

In very few cases is a complete cure obtained.

### Return to Work.

1. **Eyelids.**—Work can be resumed when a surgical cure is effected.

2. **Conjunctiva: Conjunctivitis.**—As long as there is acute inflammation the man cannot work, but as soon as he is cured he can resume his occupation.

**Lacerations and Burns.**—Work can be resumed when a surgical cure is effected.

3. **Cornea.**—In injuries and ulcers of the cornea, work may

be recommenced in unskilled occupations when a surgical cure is effected.

In occupations involving acute vision, it may be months before the vision has sufficiently recovered for the patient to resume work. In cases where the vision is permanently affected, he may be entirely precluded from resuming his original occupation.

4. **Sclerotic.** 5. **Iris.** 6. **Ciliary Body.**—After injury to these three parts, the time for return to work is the same as after injury to the cornea.

7. **Choroid.**—Vision is usually permanently injured in affections and injuries of the choroid. Work may usually be resumed when a surgical cure is effected.

Rupture of the choroid is incurable. Work may usually be resumed in about two or three weeks.

8. **Lens: Cataract.**—Work cannot be resumed until the operation has been performed and suitable glasses ordered. The time for rest is usually at least six weeks, frequently two months. When repeated operations are required, the period of suspension from work may run into several months. After glass-blower's cataract the period of total incapacity has been fixed by the Secretary of State at six months in all. This includes the time for cure after operation.

9. **Vitreous: Foreign Bodies.**—Vision is permanently injured.

**Hæmorrhage.**—Work may be resumed when the hæmorrhage is absorbed. This period varies with the severity of the hæmorrhage.

10. **Retina.**—In injuries to the retina vision is usually permanently impaired. Work may be resumed on the cessation of inflammatory symptoms.

11. **Optic Nerve.** 12. **Orbit.** 13. **Muscles.** 14. **Lachrymal Apparatus.**—Work may be resumed if and when a surgical cure is effected.

### Recurrence.

1. **Eyelids.**—Injuries to the eyelids are not followed by recurrence.

2. **Conjunctiva.**—Patients are always liable to recurrence of conjunctivitis. Other injuries of the conjunctiva are not followed by recurrence.

3. **Cornea.**—Scars, the result of corneal ulcers, sometimes break down and lead to fresh attacks of ulceration. Other

uncomplicated injuries of the cornea are not liable to recurrence.

4. **Sclerotic.**—Once cured, there is no recurrence.

5. **Iris.**—An injured iris, which has been affected with iritis, is always liable to recurrent attacks of the same disease.

Irido-dialysis, inversion, rupture of the pupil, and traumatic aniridia, if uncomplicated, are not liable to recur.

6. **Ciliary Body.**—All injuries of the ciliary body are liable to recurrent attacks of inflammation.

7. **Choroid.**—After perforating wounds the choroid is liable to recurrent attacks of inflammation, but these attacks do not occur after rupture of the choroid and extravasation of blood.

8. **Lens.**—If the operation is successful, no recurrence of trouble need usually be feared. It is to be remembered, however, that a large proportion of patients who have been operated upon for cataract may require subsequent operations for after-cataract or thickening of the capsule of the lens which is left behind after the operation.

9. **Vitreous.**—Hæmorrhage the result of injury does not recur.

Foreign bodies may, when not removed, cause recurrent attacks of inflammation.

10. **Retina.**—Injuries of the retina are not usually liable to recurrence.

11. **Optic Nerve.** 12. **Orbit.** 13. **Muscles.**—Usually no recurrence of inflammation.

14. **Lachrymal Apparatus.**—The patient is always liable to recurrent troubles and overflow of tears; he may also suffer from recurrent lachrymal abscess.

### Occupation Diseases.

**Amblyopia.**—Amblyopia, usually transient, may follow from the action of the following drugs: carbon bisulphide, nitro-benzene, iodoform, mercury, chloral, quinine, and salicylic acid.

**Anthrax.**—It is merely a matter of chance whether the eye or some other portion of the face becomes infected with anthrax. The injury, when it does occur, is destructive to the eye. (See Anthrax.)

**Arsenic.**—Arsenic rarely affects the eyes. It may cause ophthalmia in sensitive people, and, more rarely, inflammation of the optic nerve. (See Arsenic.)

**Caisson Disease.**—Ocular affections in this disease are very rare.

**Dust.**—Ophthalmia or conjunctivitis may be caused by dust produced in many occupations and trades; it is, however, so common from other causes that it is difficult in many cases to arrive at a proper diagnosis of the immediate cause. It is, however, particularly liable to affect bricklayers, plasterers, lime-workers, labourers in wool, and other dusty trades.

**Effect of Exposure to Excessive Light: Snow-Blindness, Electric Ophthalmia, Sun-Blindness.**—Partial or complete blindness, with little or no obvious ocular defect, may result from over-exposure to direct light, from direct vision of the sun, or from reflected rays from large areas of sunlit snow or water, or from a white-hot furnace or arc-lamp. The visual defect is usually severe, and as a rule permanent. There is no recognized method of treatment, operative or otherwise.

**Glanders.**—See Glanders.

**Glass-Blower's Cataract.**—The Secretary of State has recently added glass-blower's cataract to the third schedule of the diseases under the Workmen's Compensation Act. Cataract has been found to be more frequent in glass-blowers than any other persons. Between the ages of thirty and forty it is five times as frequent, between the ages of forty and fifty four times as frequent, and over fifty-three times as frequent, as in other persons. It most frequently occurs in the form of cataract on the back surface of the lens, though other varieties are met with; and it often causes very little change in the acuity of vision for the particular occupation until it has become very extensive. The treatment is by operation, for which there is an express condition in the Secretary of State's order that compensation is only to be paid for four months, unless an operation is performed, and even then for not more than six months in all.

**Lead.**—Lead may cause (a) transient blindness; (b) inflammation of the optic nerve or retina; (c) atrophy of the optic nerve; (d) degeneration of the bloodvessels of the eye. (See Lead.)

**Lime.**—Workers in lime and other dusty substances are particularly liable to chronic ophthalmia. Lime in large quantities acts as a caustic, and produces in the eye much the same effects as a burn. (See above.)

**Miners' Nystagmus.**—Nystagmus is a characteristic rolling movement of the eye, especially in extreme lateral positions,

which may be associated with general nervous disorders and visual defects.

It is common in coal-miners, and is due to the cramped and oblique position in which the miners have to work, associated with very defective illumination. It may be cured by persistent abstention from the work which caused it.

**Phosphorus.**—Very little is known of the effects of phosphorus upon the optic nerve, as patients usually die before changes become apparent. There are, however, usually hæmorrhages into the retina. (See Phosphorus.)

### Diagnosis.

1. **Eyelids.**—Injuries to the eyelids present no difficulty of diagnosis.

2. **Conjunctiva.**—There is no difficulty in diagnosing injury to the conjunctiva.

Adhesions between the conjunctiva and the eyeball may also occur in disease, especially in granular ophthalmia, which is common among Jews, Irish, and Egyptians, and hence called "Egyptian ophthalmia."

A careful examination should be made in all cases for the characteristic symptoms of this disease.

Shrinkage of the conjunctiva also occurs in pemphigus and xerosis.

3. **Cornea.**—Injuries of the cornea present no difficulty in diagnosis, and there is also no difficulty in diagnosing the presence of a corneal ulcer, or determining whether it is old or recent.

The decision as to whether a corneal ulcer is the result of any specific injury or due to disease is most difficult, and depends upon the circumstances of the case. Ulcers are common in cases of ill-health and malnutrition, especially in children and nursing mothers.

4. **Sclerotic.** 5. **Iris.** 6. **Ciliary Body.**—The diagnosis of injuries of the sclerotic, iris, and ciliary body, presents no difficulties.

As has been mentioned above, inflammation of the iris without external wound is practically never due to injury.

7. **Choroid.**—Rupture of the choroid may be mistaken for choroiditis, or *vice versa*. The linear nature of a rupture of the choroid, its proximity to the entrance of the optic nerve, and the absence of inflammation, are usually sufficient to determine its nature.

8. **Lens.**—Cataract is exceedingly common without injury.



If the cataract be caused by a punctured wound, the diagnosis of a traumatic cataract is easy, as the position of the external wound and the injury to the lens will be in a line.

If the cataract is caused by a blow without external wound, the diagnosis is more difficult. Such cataract is, however, unilateral, whereas senile cataract is more commonly bilateral. It is often associated with dislocation of the lens. (See above.) It is not likely to be confused with anything but a diabetic cataract, or one secondary to some inflammation within the eye itself. The patient should be examined with a view to excluding such causes.

The diagnosis of a traumatic cataract is usually easy, owing to a well-marked tremulousness of the iris; but it is to be remembered that the condition may also be congenital. In such a case, however, the dislocation is usually bilateral.

9. **Vitreous.**—Persons suffering from Bright's disease, diabetes, and various blood diseases, are very liable to hæmorrhages in the vitreous without injury. These conditions must therefore be considered and excluded before it can be asserted that a vitreous hæmorrhage is due to an accident.

10. **Retina: Snow-Blindness, Electric Ophthalmia, Sun-Blindness.**—The only disease likely to be confused with such conditions is tobacco-blindness, which would also predispose to such an affection, and is associated with irregular pulse and other symptoms of tobacco-poisoning.

11. **Optic Nerve.**—It is to be remembered that atrophy of the optic nerve may be associated with general nervous diseases, such as locomotor ataxy or late stages of syphilis. Any case of atrophy should be examined with a view to the exclusion of such cases.

12. **Orbit.**—The diagnosis of injuries to the orbit is usually obvious.

13. **Muscles.**—Injuries to the muscles must be distinguished from muscular paralysis due to general nervous diseases, such as locomotor ataxy, late syphilis, and tumours and affections of the brain.

14. **Lachrymal Apparatus.**—There is no difficulty in the diagnosis of these injuries.

### Malingering.

Patients may pretend partial or total blindness of one or both eyes. It is very difficult to disprove alleged partial blindness of both eyes, and a proper opinion can only be

arrived at by repeated examination under varying circumstances, when conflicting answers will usually be elicited.

Partial or total blindness of one eye can, as a rule, be easily detected in a variety of ways—by crossed prisms, red and green types, and other methods capable of easy demonstration, but which it is inadvisable to specify here.

The pupil will not as a rule react directly to light in a totally blind eye, though a tumour in the brain might cause total failure of the vision, with persistent pupil reflex.

### General Considerations.

In considering the value of an eye, the general visual powers of the eye must be considered seriatim, and it is essential to a proper estimation of any visual loss to appreciate the different ways in which the eye may be of use.

**Central Visual Acuity.**—The commonest test is that for central visual acuity. The ordinary test is the reading of letters on a board at a definite distance, and the reading of types of various sizes held at the ordinary reading distance. This is a very good test of a man's useful vision for all fine work, such as reading, writing, engraving, or similar pursuits.

The area of the field of vision which is employed in such test is, however, a very small part of the total field, the size of the area being no larger than a thumbnail held at arm's length. The rest of the visual field, which, as is well known, covers a large area, bounded by the eyebrows, the nose, and on the outer side by a line running straight out from the head a little behind the ear, is concerned with indirect, and to a certain extent indistinct, vision, which is of great importance in movement and direction—for example, to give an instance of two varieties of affection of the visual field.

The man may have a small loss of his visual field exactly in the centre, and be absolutely unable to read or write or do any fine work. He will be, however, quite able to walk about with perfect safety, and get through his life very comfortably without accident. On the other hand, a man who has lost all the peripheral part of his field of vision may be able to read the finest print or do the finest work, but yet may be unable to ~~choroid~~ about without assistance, as he cannot see where he is choroid, and is unable to perceive objects approaching him the absence side. His vision could be best appreciated by the its nature. or trying to walk about looking down a roll of

**Accommodation.**—By accommodation is meant the focussing power of the eye to give distinct vision, as occasion may require, of distant or near objects. As is well known, this focussing power is best in infancy, and slowly decreases with increasing age, until by the age of forty glasses become necessary for near work with a normal-sighted person. By fifty-five or sixty in the normal person all focussing power has, as a rule, disappeared. The importance of this may be realized more fully in the discussion of the loss to an eye of its lens. (See Cataract.)

**Mobility.**—The visual power of the eye is also very much increased by the active mobility of each eye separately, and by their accurate co-ordination.

Injuries which may affect the muscular equipment, which performs movements, may have a very detrimental effect on useful vision.

**Stereoscopic Vision and Perception of Distance.**—Valuable as each eye may be individually, their value together is very much greater than the simple sum of the two individual eyes.

A single eye by itself has practically no perception of space, shape, or distance. The combination in the brain of the images formed by the two eyes, each taking a view of an object from a little different standpoint, gives the ordinary person his sense of distance. The loss or injury of one eye, therefore, means to a patient a great loss in these respects.

**Colour Vision.**—Defects of colour vision are as a rule congenital, and can be tested by the ordinary tests for colour-blindness, of which it is unnecessary to enter into detail here.

As a rule colour vision is not affected by accident, but may be partially or entirely lost as the result of old age, alcoholism, or excessive smoking.

It will be seen from the above short discussion of the various optical properties of the visual apparatus that claims for compensation should be discussed on quite different terms when dealing with workmen in different trades. An injury which might ruin a clerk might leave an unskilled labourer comparatively unaffected or little damaged, since the former depends for his livelihood on a high proficiency of a very limited part of his vision, while the latter depends rather on a general rough, low grade of ability. It is impossible, therefore, to lay down definite rules or a scale of compensation. Each case should be argued on its own merits, attention being

paid to the particular injury in question, and the class or amount of vision required.

#### Criminal and Self-inflicted Wounds.

**Injuries to the Conjunctiva.**—These can be, and have been, self-inflicted, but it is impossible to lay down any general rule as to their detection, which may be extremely difficult.

Other injuries of the eye are practically never self-inflicted by the sane; but the insane may attempt to pluck out their own eyes, and in some cases have succeeded.

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*For legal cases of injury to the Eye, see CASE-GUIDE : Eye.*

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### FARCY.

*See* GLANDERS.

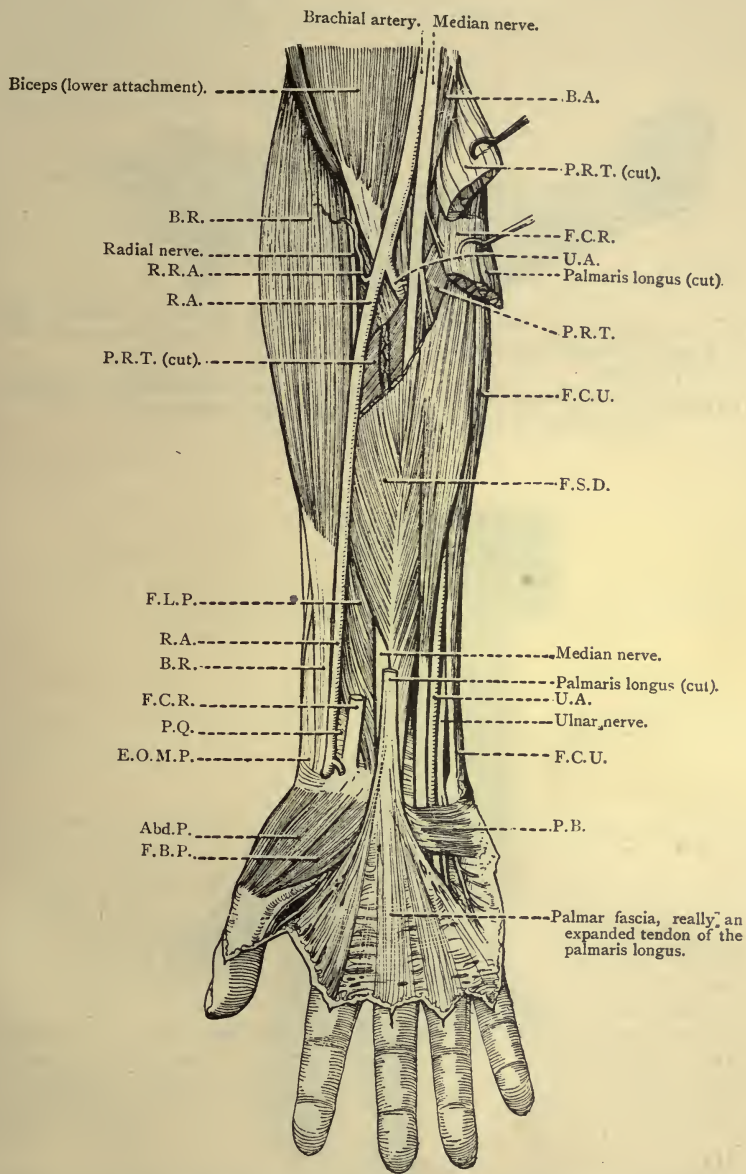


FIG. 76.—FRONT OF THE FOREARM WITH THE SKIN, TISSUE UNDER THE SKIN, AND FASCIA, REMOVED, EXCEPT ON THE PALM.

The letters indicate muscles, nerves, and arteries, by their initial letters.

(From Buchanan's "Anatomy.")

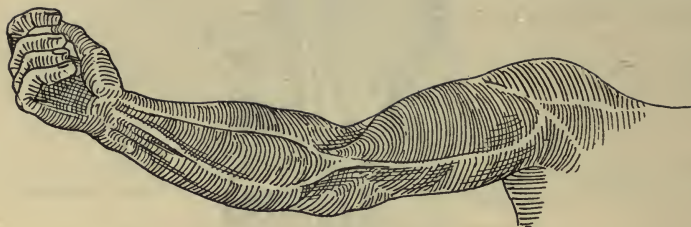


FIG. 77.—FASCIAE OF THE ARM: ARM WITH SKIN REMOVED, SHOWING THE FIBROUS SHEATH (SUPERFICIAL FASCIA) WHICH BINDS TOGETHER THE PARTS OF THE ARM.

The position of the deeper bands, or partitions, which pass between the groups of muscles is shown by the furrows (semi-diagrammatic).



FIG. 78.—THE FRONT OF THE LEFT HAND, SHOWING CONTRACTION OF THE LAST TWO FINGERS, PRODUCING WHAT IS KNOWN AS "DUPUYTREN'S CONTRACTION."

(From Rose and Carless's "Surgery.")

# FASCIÆ.

By A. H. TUBBY,

M.S. (LOND.), F.R.C.S. (ENG.),

Surgeon to the Westminster Hospital and to the Royal National Orthopædic Hospital for the Deformed; Consulting Surgeon to the Evelina Hospital for Children;

AND

E. RÖCK CARLING,

B.S. (LOND.), F.R.C.S. (ENG.),

Assistant-Surgeon to the Westminster Hospital; Senior Assistant-Surgeon to the Seamen's Hospital, Greenwich.

## Head-note.

THERE is no special danger attaching to injury of fasciæ and aponeuroses.

## Technical Terms.

*Ἀπὸνεῦρωσις*.—A flat sheet of fibrous tissue specially adapted to extend and distribute the pull of muscle fibres.

*Fasciæ*.—Sheets of fibrous tissue which envelop other tissues, bind together groups of muscles, and support internal organs, etc. (See below, Anatomy.) From the underside of the fasciæ which ensheath a limb, expansions pass down to the bone. As these are also continuous sheets, they separate the muscles, etc., between which they run, and keep them in compartments. By this means the direction of the spread of inflammation is sometimes guided and restricted. This is especially well seen in inflammatory conditions of the neck. [Figs. 76, 77.]

## Anatomy.

**Fascia and Aponeurosis.**—Fasciæ are sheets of fibrous tissues which envelop other tissues, bind together groups of muscles, or serve to protect underlying structures—*e.g.*, in the palm—being stretched from one bony eminence to another. [Figs. 76, 77.] They also invest and support many of the internal viscera, such as the bladder and other pelvic organs.

Sometimes they are specially adapted to extend and distribute the pull of muscle fibres, and then are known as "aponeuroses."

### Consequences of Accident.

- (i.) Wounds.
- (ii.) Rupture.
- (iii.) Chronic or repeated irritation.

(i.) **Wounds.**—Wounds of these structures are almost invariably associated with wounds of other and more important structures, and the injury to the fasciæ does not materially increase the gravity of the accident.

(ii.) **Rupture.**—The widest sheets of fasciæ or aponeuroses are found in the back, and their fibres may be ruptured by attempts to lift very heavy weights or in pushing with the shoulders. For example, the "forwards" in a Rugby "scrum" sometimes detach or rupture fibres attached to the spinal column at the junction of the back of the neck with the trunk. Dupuytren's contraction (for which see Occupation Diseases) has been known to follow injury to the palmar fascia. [Figs. 77, 78.]

(iii.) **Chronic or Repeated Irritation.**—See below, Occupation Diseases.

### Disease.

Fasciæ are sometimes the seat of calcareous (chalky) or bony deposit; injury has been alleged as a determining cause. They are also subject to acute inflammations, occasioned by the poisons of rheumatism and gonorrhœa; then they are much softened and are liable to stretch, permitting in some instances alteration in the positions and relations of bones. Flat-foot is commonly so produced.

### Operation.

Ruptured fasciæ rarely, if ever, require operation; contraction of fasciæ in some situations may necessitate an open operation to dissect away the retaining bands, but often it is enough to divide the bands by a subcutaneous incision (tenotomy or fasciotomy). Similar remarks apply to the treatment of Dupuytren's contraction.

### Cure.

1. Rupture—twenty-eight to fifty-six days.
2. Dupuytren's Contracture—twenty-eight days after operation.



### Return to Work.

After surgical cure rest for a week is sufficient in a case of injury to fasciæ before return to work.

### Recurrence.

There is little likelihood of recurrence of any of the effects of accident to fasciæ and aponeuroses, except in Dupuytren's contraction after operation.

### Occupation Diseases.

**Dupuytren's Contraction.**—This is an affection of the palmar fascia occasionally occurring as a result of repeated irritation, and in very rare cases of slight wounds of the palm. In most cases no relation to injury can be demonstrated.

It is seen in gardeners, cobblers, wicket-keepers, and carpenters, but it also arises where no injury or accident has occurred and the hands have not been used for labour. Barristers and Bishops have been known to suffer. [Fig. 78.]

### Diagnosis.

Lumbago, sciatica, and vague "backache" are often attributed to strains when at work. In many cases, no doubt, some of the fibrous bands are torn by straining efforts; in other cases they are merely stretched. In genuine cases of rupture the affected areas can be detected as tender spots, and there is some slight swelling due to the blood or other fluid poured out. Traumatic lumbago occurs after railway accidents, and the patient frequently thinks that paralysis is coming on. The exact causation of lumbago is a matter of dispute, but it is agreed that injury plays only a small part in its production. The poisons of gout, rheumatism, gonorrhœa, and possibly others derived from fermentative processes in the alimentary canal, are responsible for the inflammatory or degenerative conditions of the fasciæ, muscles, nerves, and vessels, which cause the pain. The sudden onset of severe pain, which may have been heralded for some days by uneasiness in the back, is not infrequently determined by prolonged stooping, such as falls to the lot of a surgeon in a long afternoon's operating, or by some exertion not necessarily unusual in degree; the deciding factor, in other words, is generally not an "unexpected" event.

**Sciatica** may usually be excluded, as it is rarely, if ever, the result of injury. It is an affection of the great nerve at the back of the thigh, and the genuine affection can readily be recognized by well-known tests; the vague pains in the upper part of the thigh, to which the term "sciatica" is commonly, but erroneously, applied by the public, and especially by the class of patients who go to hospitals, are generally due to simple bruising, or to the effects of contusion or exposure in a hip-joint previously unhealthy.

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*For legal cases of injury to Fasciæ, see CASE GUIDE: Fascia.*

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## FEMALE—GENERATIVE ORGANS OF.

*See* GENERATIVE ORGANS—FEMALE.

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## FINGERS—AMPUTATION OR LOSS OF.

*See* LAW CASES.

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## FOOD PASSAGES.

*See* ŒSOPHAGUS.

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## FOOD POISONS.

*See* PTOMAIN-POISONING (PRESERVATIVES AND ADULTERANTS IN FOOD).

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## FROST.

*See* COLD.

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## GALL-BLADDER.

*See* LIVER.



FIG. 79.—DRY GANGRENE (SENILE).

The sharp raised line separates the black, dead, gangrenous part from the healthy part above ; this is "the line of demarcation."

(From Rose and Carless's "Surgery.")



FIG. 80.—MOIST GANGRENE (AFTER OBSTRUCTION OF THE MAIN ARTERY OF THE LEG BY AN EMBOLUS.)

No line of demarcation has formed.

(From Rose and Carless's "Surgery.")



FIG. 81.—INFECTIVE MOIST GANGRENE.

(From Rose and Carless's "Surgery.")

# GANGRENE.

By EDRED M. CORNER,

M.C., F.R.C.S.,

Surgeon to the Children's Hospital, Great Ormond Street; Surgeon to the Surgical Infectious Wards and to the Out-Patients, St. Thomas's Hospital.

## Head-note.

By gangrene or necrosis is meant the death of part of the body. The disease is local.

## Technical Terms.

*Ānæmia*.—A disease of the blood.

*Āthērōma*.—A disease with narrowing of the channel and thickening of the walls of an artery. It is associated, among other things, with old age.

*Cautery*.—Destruction of tissues with a cautery, such as a hot iron, nitric acid, etc.

*Compound Fracture*.—A broken bone communicating with a wound in the skin.

*Consumption*.—Tuberculosis, usually of the lungs. Due to the tubercle bacillus.

*Ēmphŷsēmātous Gangrene*.—Gangrene associated with air or gas under the skin.

*Fever*.—See Temperature.

*Line of Demarcation*.—A red (inflammatory) line marking the limits of the dead (gangrenous) and living tissues. [Fig. 79.]

*Sŷphĭlis*.—A disease which may affect all the tissues in the body. Due to a micro-organism called a "Spirochæta."

*Temperature*.—The temperature of the human body is 98.4° F. Above 99° constitutes fever; below 98° is subnormal.

*Traumatic Gangrene*.—Gangrene caused by injury (trauma).

## Anatomy.

Gangrene is the death of a part of the body remaining attached to the living tissues.

There are two main kinds: (1) Dry gangrene, where the blood is prevented from entering the part and the fluid drains out; (2) moist gangrene, where the blood does not enter, but also where the fluids do not drain out.

In each case the line of demarcation appears between the living and the dead parts, unless the patient is unable to resist the spread of the gangrenous process. Under the most favourable conditions, the limits of the dead part become defined by the line of demarcation, at which place the dead tissues become separated from the living. If no definite line of demarcation is formed, and the gangrene allowed to spread, death is bound to ensue. In Fig. 80 no line of demarcation has appeared. Amputation well above the gangrene is the only chance of saving life.

#### Consequences of Accident and Disease caused by Accident.

The following are the gangrenous conditions which are caused by accident:

- (i.) Dry gangrene (vessels always diseased).
- (ii.) Moist gangrene (vessels not necessarily diseased).
  - (a) Simple moist gangrene.
  - (b) Infected, specific, or acute spreading traumatic gangrene (primarily due to infection by microbes which produce the condition).
- (iii.) Splint gangrene.
- (iv.) Phagedena.
- (v.) Noma.

(i.) **Dry Gangrene** [Fig. 79].—This is a condition of the tissues in which death has taken place, followed by drying or mummification. It is almost always associated with senile and degenerative change (atheroma) in the arteries, consisting in a thickening of their walls, which produces a gradual narrowing of their channels. Thus, dry gangrene is not the result of injury alone, the changes in the arteries acting as the great predisposing cause.

The progress of the dry gangrene is slow. The disease begins with pain in the part, which subsequently becomes black and greasy; between the dead and the living tissues a red line appears, which marks an attempt on the part of the living tissues to separate and cast off the dead part. Owing to the

diseased vessels in these cases, the living tissues may fail; and a second, third, or even more, red lines appear higher up the limb. These red lines are called the "lines of demarcation," as they mark off the dead from the living parts. In this disease the patient may suffer much from pain, but, beyond the accompanying loss of sleep and appetite, from little else. The disease spreads very slowly or not at all. (See below, Diagnosis.)

(ii.) **Moist Gangrene.**—This, as the term implies, means the death of a part of the body in which fluid remains. There are two kinds: (a) Simple moist gangrene; (b) infective or specific.

(a) *Simple Moist Gangrene* [Fig. 80].—In the so-called "simple moist gangrene" the prime cause is obstruction to the circulation of the blood, and though bacteria are not the original cause of the condition, yet they rapidly gain an entry into the dead part and produce symptoms of greater or lesser severity. Hence the distinction between simple and infective moist gangrene is speedily lost. This form of moist gangrene may occur at any age, in which respect it is unlike dry gangrene, and it does not depend on any disease of the walls of the arteries. When caused by accident, it follows some injury, usually a fracture of bone complicated by pressure on the vessels, or possibly rupture of their walls. In moist gangrene, besides the pain, the patient suffers from the consequences of absorption of the poisons produced by the bacteria—septic intoxication. This septic intoxication is caused by the absorption of the products of the bacilli of putrefaction. Indeed, the man may be so acutely ill that it is necessary to operate before any line of demarcation between the living and dead parts has disappeared. In moist gangrene the man has a raised temperature, increased rate of pulse-beat, etc.; whilst in dry gangrene he may have a subnormal temperature, a slow pulse, etc.

(b) *Infective, Specific, Acute Spreading Traumatic Gangrene, or Emphysematous Gangrene* [Fig. 81].—In this case the gangrene is caused by the direct infection of the living tissue with the microorganisms. An example of it is acute spreading traumatic or emphysematous gangrene, the most fatal of all forms of gangrene following a wound. The cause is the entrance of microbes through a wound. The wound is usually severe, such as a compound fracture, so that, in addition to the infection of a wound by these microbes, an injury to the vessels aggravates the condition. Many different organisms have been known to

produce the disease. If only one kind of virulent organism is present as the cause of the gangrene, it is usually the one known as *Bacillus aerogenes capsulatus*; but other organisms are known to cause the disease, and commonly the infection is of more than one kind—*i.e.*, it is a mixed infection. A very common bacillus is one which is found in the human intestines and is present in so many forms of bacillary poisonings, *viz.*, the *Bacillus coli communis*. When gangrene is caused by a mixed infection, this bacillus is frequently found. The gangrene tends to spread steadily, and if operation is not performed early the disease is usually fatal. The symptoms are those of a very acute inflammatory process. Pain is the first, and generally the most prominent. The part becomes discoloured, the tissues full of bubbles of air, the process often advancing visibly in an hour's time. High fever is sometimes present, but in the most fatal cases it may be below normal. Unless operation is undertaken at once, death will ensue in a day or two.

(iii.) **Gangrene from Splintage.**—There is another cause of traumatic gangrene, which is now mainly of historical interest in relation to surgical treatment, but requires separate mention.

In the treatment of fractures it is often necessary to apply splints firmly to the injured part. In spite of all precautions, necrosis and gangrene may set in, and the damage be done, before symptoms have declared themselves sufficiently to attract attention. The only symptoms may be pain of a slight nature, such as might be expected from the injury, which may appear insufficient to necessitate removal of the splints. Probably the condition is due to a combination of the results of the injury and of the firm application of the splints. It is wrong to attribute it to either one or the other.

(iv.) **Phagedena.**—Another form of specific gangrene is phagedena, which consists of a rapidly spreading ulceration, usually terminating fatally. It was very common among those wounded in the wars in the middle of the last century. Since the introduction of improved sanitation and antiseptics it has almost ceased to exist.

(v.) **Noma.**—This is the name given to another form of gangrene due to definite microbes. When the mouth is affected, it is called a “*cancrum oris*.” It is found most often in the cheek of a child recovering from measles, but it also

occurs about the external genitals, usually of a female child which is badly nourished and ill-kept. Its occurrence may be alleged to be due to negligence on the part of those in charge of the case. But noma is more due to lack of resisting power in the child than to anything else.

The organism generally found is known as the *Streptococcus pyogenes*. Noma rarely, if ever, follows an injury. The process begins as an inflammation of some slight abrasion of the surface, followed rapidly by ulceration and gangrene.

### Disease.

1. **Caused by the Accident.**—See above, Consequences of Accident.

2. **Existing before the Accident and aggravating its Effects.**—All forms of gangrene may be exaggerated by the presence of other diseases in the body of the injured person. Among these may be mentioned—

- (a) All weakly conditions, such as may result from syphilis, consumption, or anæmia.
- (b) Diseases of arteries, particularly atheroma.
- (c) Nervous diseases.
- (d) Diabetes.
- (e) Some blood diseases, such as scurvy.
- (f) Kidney diseases.

### Operation.

(i.) **Dry Gangrene.**—The dead part may become separated and the part heal naturally; but this necessitates dangerous delay, and often it is necessary to amputate part of the limb. Dry gangrene is most often seen in the big toe, and the amputation is usually then done above the knee.

(ii.) **Moist Gangrene.**—Amputation must be done. If it is possible to await the formation of the red line of demarcation, the amputation may be done just above it; but if it is not possible to wait for this, the amputation must be done well above the gangrene.

In some cases, if seen and recognized early, it may suffice to incise freely, drain, and wash the wounds. This, however, ought only to be undertaken where no signs of general infection of the body have shown themselves. All delays are dangerous, and operative treatment may have to be resorted to on first seeing the case.



(iii.) **Splint Gangrene.**—Splint gangrene, as the particular case may be, whether dry or moist, is treated as described above.

(iv.) **Phagedena.**—This is best treated by cutting away the dead parts, and washing the part with antiseptics and baths for several hours daily.

(v.) **Noma.**—All the diseased part must be cut away, and the wounds cauterized, usually with strong nitric acid.

### Cure.

Gangrene must result in the loss of some portion of the body, with consequent deformity and disability.

As regards cure, gangrene associated with vascular lesions, kidney disease, or diabetes, is the slowest to heal. Acute specific gangrene is the most fatal.

Phagedena and noma are usually recovered from, but with deformity.

### Return to Work.

In consequence of the necessary forms of treatment, there must be some permanent disability, but otherwise the man can do some work when surgical cure is complete. The time taken for convalescence will include the healing of the wound, the recovery from shock, and perhaps the fitting of an artificial limb, the length of which time will vary with the age and condition of the patients from three months to a year.

### Recurrence.

The only form of gangrene which shows any tendency to recur is the dry form. Strictly speaking, this is not a recurrence; such parts of the body as have become gangrenous are always removed. But disease of the arteries is general in the body, and the same cause which produced one attack may produce another.

### Diagnosis.

Dry gangrene occurs commonly without the history of an accident. It is found in old age, and though the sufferer may seek to find an accident to account for it, yet in most cases the gangrene is not caused by accident. If the affected part is directly injured, then the gangrene is reasonably said to be

due partly to old age, and partly due to accident. Where, for example, the injury is merely to one toe, and gangrene of the other foot follows, there is no direct relationship to the accident.

#### Malingering.

The form of malingering that is most likely to occur is that an accident is asserted to be the cause of gangrene, which was in fact produced by disease. Men have been known to produce gangrene; such as by tying ligatures round their limbs to escape work, punishment, or conscription.

#### Criminal and Self-inflicted Wounds.

A tight string has sometimes been placed round various parts of the body to cut off the circulation beyond so producing gangrene. It is incredible how determined a man can be under such circumstances. In the College of Surgeons Museum are two dried, mummified feet which were intentionally rendered gangrenous by their owner tying a tight string above the ankle until the feet actually mortified and separated. The intention was to incite sympathy through his having no feet, and enable to him to follow his profession of a beggar. (See also Generative Organs—Male (pp. 404, 405).

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*For legal cases concerning Gangrene, see CASE GUIDE: Gangrene.*

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## GASEOUS POISONS.

*See* CAISSON DISEASE, POISONS.

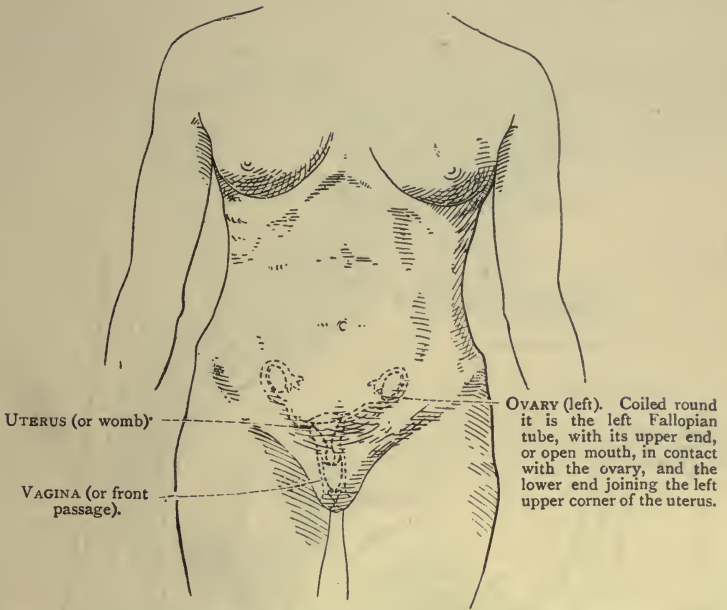


FIG. 82.—PROJECTION OF THE GENERATIVE ORGANS OF THE FEMALE, SEEN FROM THE FRONT. THE BLADDER, WHICH LIES IN FRONT OF THE VAGINA, IS NOT SHOWN.

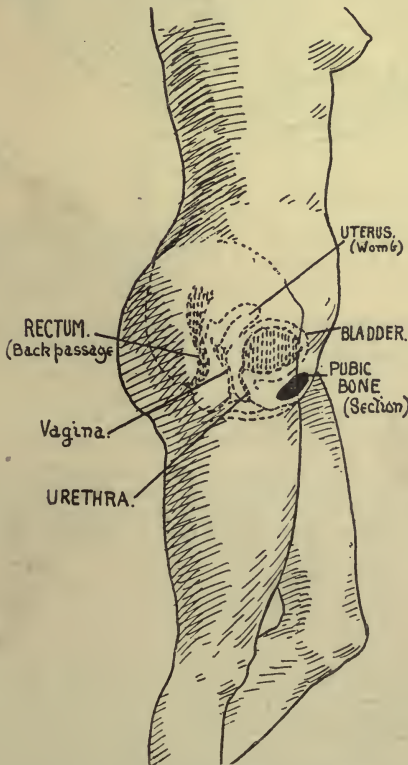


FIG. 83.—PROJECTION OF SIDE-VIEW OF THE GENERATIVE ORGANS OF THE FEMALE.

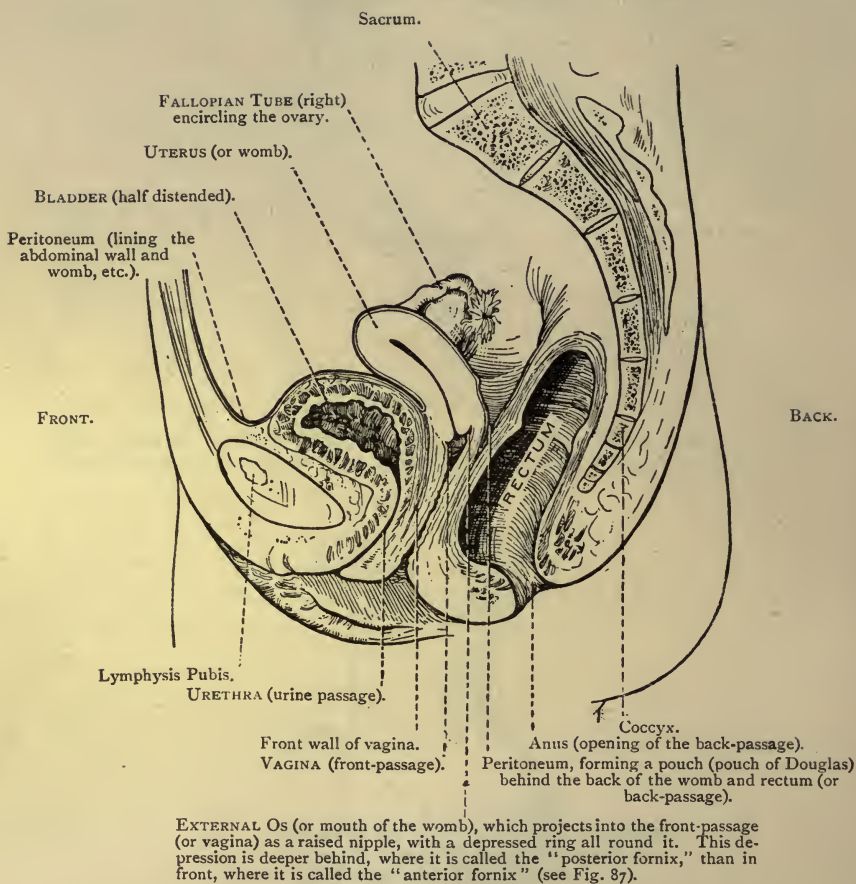


FIG. 84.—VERTICAL SECTION THROUGH THE LOWER PART OF THE ABDOMEN OF A WOMAN, SHOWING THE POSITION OF THE GENERATIVE ORGANS.

Most of the other organs, except the bladder and end of the bowel (the rectum, or back-passage), have been removed, but the lining of these parts (the peritoneum) is left. It will be seen to cover the top of the bladder, front, top, and back of the womb, a very small part of the back of the vagina, and part of the rectum.

(From Buchanan's "Anatomy.")

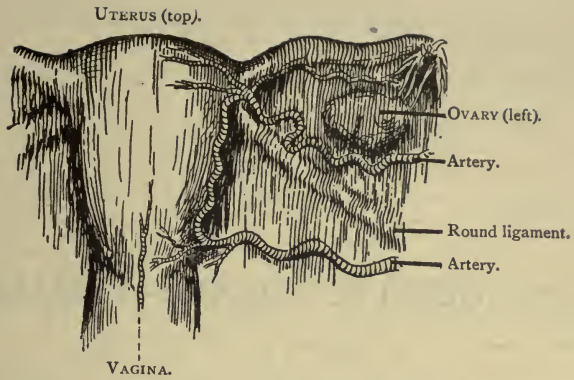


FIG. 85.—UTERUS (WOMB), WITH LEFT OVARY AND FALLOPIAN TUBE, SEEN FROM THE FRONT.

(From Allingham's "Operative Surgery.")

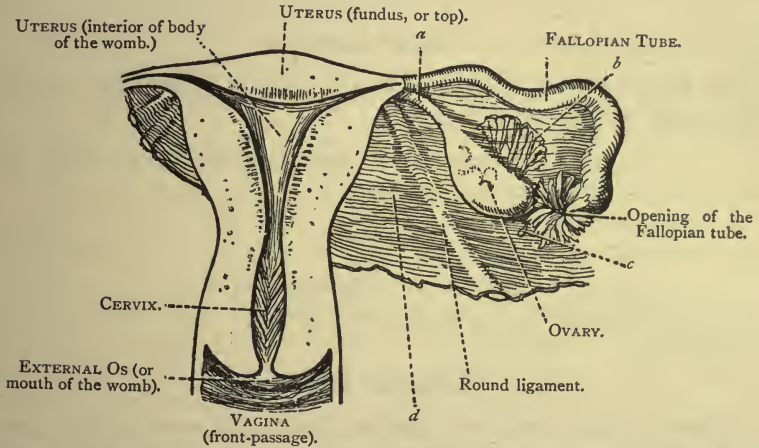


FIG. 86.—UTERUS, REMOVED AND OPENED FROM THE FRONT, WITH THE LEFT FALLOPIAN TUBE, OVARIES, ETC.

The vagina is opened and cut below; *a* to *d* are named parts.

(From Buchanan's "Anatomy.")

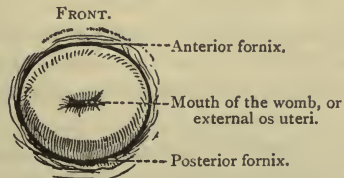


FIG. 87.—THE EXTERNAL OPENING OF THE WOMB (OR UTERUS) INTO THE FRONT-PASSAGE (OR VAGINA), SEEN FROM BELOW.

Notice how it projects into the front-passage as a nipple, with a depressed ring all round it. The front part of this ring is called the "anterior fornix," the back and deeper part, the "posterior fornix." (See Fig. 84.)

(From Buchanan's "Anatomy.")

## GENITAL ORGANS—FEMALE.

By THOMAS G. STEVENS,

M.D., B.S. (LOND.), F.R.C.S. (ENG.), M.R.C.P. (LOND.),

Physician to Out-Patients, Queen Charlotte's Lying-in Hospital ;  
Physician to the Hospital for Women, Soho Square ;  
Obstetric Tutor, St. Mary's Hospital,  
Paddington.

### Head-note.

THE dangers from accidents to the female generative organs fall under the following heads :

1. Spread of inflammation, especially to the peritoneum, causing peritonitis.
2. Bleeding.
3. Shock.
4. Injury to bladder and back-passage.
5. Miscarriage or premature labour.

### Technical Terms.

*Abortion.*—The premature discharge from the womb of the child at a period before the sixth month of pregnancy. Before this period the child is not considered capable of living after birth. At law the discharge of the child at any time before full term is always called "abortion." (See Premature Labour.)

*After-birth.*—See below, Placenta.

*Bearing-down Pains.*—A phrase commonly used in two senses—(1) To express a feeling of pressure in the lower part of the abdomen, commonly referred to as the "back-passage"; (2) to express the voluntary straining-down which accompanies the expulsion stage of labour.

*Căpūt Sūccēdānēum.*—See below, Hæmatoma.

*Cervix.*—The mouth of the womb, lower segment, the lips of which extend to the front-passage, into which it opens by an aperture about  $\frac{1}{8}$  inch in diameter. It contains a short canal about  $\frac{3}{4}$  inch long, which communicates with the body of the womb. [Fig. 86.]

*Cystitis.*—The technical term for inflammation of the bladder

*Ěxtrāūtěvīne Gestation.*—Development of a child in the Fallopian tube instead of the womb. [Figs. 85, 86.]

*Ěndōmētrītis.*—Inflammation of the lining of the womb.

*Fällōpīan Tubes.*—The tubes leading from the ovaries to the womb down which the unfertilized egg is passed to the womb. [Figs. 85, 86.]

*Fētūs.*—The immature child.

*Fündūs.*—The top of the womb. [Fig. 86.]

*Hēmātōma.*—A tumour of blood formed under the skin, usually in consequence of injury, occasionally in the outside parts of the female organs. The word is used for a collection of blood anywhere, and includes a swelling on the head of a newly born child, containing blood, which occurs at times after prolonged labour (caput succedaneum).

*Hēmōrrhāge.*—The scientific word for bleeding.

*Involution.*—The process which occurs during the month after delivery, in which the womb gradually contracts and returns to its normal size. (See Subinvolution.)

*Lābia: Labia Majora and Minora.*—The two pairs of lips, outer and inner, of the external part of the female organs.

*Mēnōpāuse.*—The natural cessation of menstruation, which may occur at any time after the age of forty. It usually, but not always, denotes that the period of fertility is past.

*Mēnstruātion.*—The monthly discharge of blood, etc., which occurs in women during their child-bearing period of life.

*Miscarriage.*—A popular term for the discharge of the contents of a pregnant womb before full time.

*Mūcous Membrane.*—The soft, red, moist skin lining the inner parts of the body which are accessible to atmosphere. In women it is the skin lining the front-passage, womb, urethra, bladder, back-passage, etc.

*Ōs or Ōs Ūtēri.*—The mouth of the womb, the lips of which protrude into the front-passage. [Figs. 84, 86, 87.]

*Ōvāriān.*—Pertaining to the ovary—*e.g.*, ovarian tumour, a tumour of the ovary.

*Ōvarý.*—The gland which forms the human egg. [Figs. 84, 85, 86.]

*Ōvūm.*—The human egg.

*Pēlvis.*—The large ring of bone which forms the hips, containing the internal generative organs, bladder, and back-passage, and to which the legs are attached below and spine and abdomen above; its halves are united in front as the symphysis pubis.

*Pěvīnēým.*—The small space of some  $1\frac{1}{4}$  inches which separates the front and back passages.

*Pěvītōněum.*—The thin glossy lining of the inside of the abdomen, which is spread sheet-like over all the contents of the abdomen. It covers the top of the bladder, the womb, the tubes, the ovaries, and the intestines, kidney, liver, etc. [Figs. 84, 150, 151, 152, 153.]

*Pěvītōnītis.*—Inflammation of the peritoneum.

*Pēr Vāgīnam, or "P.V."*—The medical term for a thorough examination by a medical man of the inside parts of the female organs by the insertion of the finger into the vagina.

*Pēssāry.*—An instrument or mechanical contrivance inserted into the vagina to keep the womb in position after a displacement.

*Plācēnta.*—The "after-birth"; the broad attachment of the child to the womb of the mother, shed immediately after birth. It is about 6 inches in diameter, and normally is more or less circular and flat. From the middle of it comes the cord (the umbilical cord), which is attached to the child at its navel, and has to be cut at birth. The placenta is the organ by means of which gases and fluids pass between the child and mother, and by which the child is fed, breathes, and is relieved of its waste products.

*Premature Birth.*—The birth of a child capable of living which takes place from the sixth month of gestation. (See Abortion.)

*Prōlapse.*—A descent of the womb, usually pulling down with it the vaginal walls, the bladder, and tubes. It may even be exposed to the outside through the front-passage. (See below, Disease.)

*Pūbēs.*—The skin and parts of the body which are just above the sexual organs. Strictly speaking, it is the union of the two halves of the bony pelvis. (See above, Pelvis; and below, Symphysis Pubis.)

*Pūdēnda.*—The external parts of the generative organs.

*Pūērpēval Fever.*—A fever which attacks women after delivery. It is of the nature of a blood-poisoning, and is very infectious from one recently delivered woman to another.

*Pūērpēvium.*—The period of recovery which succeeds delivery, usually about a month.

*Rēctūm.*—The back-passage. [Figs. 83, 84.]

*Rēctō-Vāgīnal Fīstūla.*—An abnormal hole from the back-passage into the front-passage.

*Retroversion or Retroflexion.*—An abnormal turning or bending back of the womb. (See Disease.)

*Round Ligament.*—A thin cord attached at the corners of the womb in front of the Fallopian tube (see above), and extending through two small holes in the wall of the abdomen—the external and the internal ring. (See Rupture.) It is further attached by its outer end to the external parts (labia majora). [Figs. 85, 86.]

*Sālpingītis.*—Inflammation of the Fallopian tubes. (See above.)

*Subinvolution.*—The incomplete return of a womb to its normal size after a confinement. (See Involution.)

*Symphysis Pubis.*—The joint in front between the bones of the pelvis, usually immovable and filled with cartilage. [Figs. 83, 84.]

*Tubes.*—See above, Fallopian Tubes.

*Umbilical Cord.*—See Placenta.

*Urēthra.*—The urine-pipe from the bladder, in women, lying in the front wall of the front-passage (vagina). [Figs. 82, 83, 84.]



*Ūrētēr.*—The urine-pipe from the kidney to the bladder [Figs. 128-130.]

*Ūtērus.*—The womb. [Figs. 82, 83, 84, 85, 86, 87.]

*Vāgīna.*—The front-passage. [Figs. 82, 83, 84, 85, 86.]

*Vēsicō-Vāgīnal Fistula.*—An abnormal hole through the wall of the bladder into the front-passage.

*Vūlvā (Pūdēnda).*—The external parts of the female generative organs.

### Anatomy.

This must be considered under three heads:

The actual feminine organs themselves.

The bladder and its accessories.

The back-passage, or rectum.

**The Female Generative Organs.**—The outside parts of the female generative organs consist of the larger and smaller lips (*labia majora* and *minora*), concealing the entrance to the bladder and to the front-passage, or vagina. The front-passage, or vagina, extends deeply inwards some 3 or 4 inches, the external opening being partly closed in the virgin by a thin layer of skin, the hymen. The deeper end of the vagina reaches to the womb, which projects into the vagina in the form of a raised, thick-walled ring round its mouth. This mouth of the womb (*os uteri*) is about  $\frac{1}{8}$  inch in diameter. The womb itself is a pear-shaped organ, about 3 inches long in the case of women who have not had children, and slightly larger in those who have had children. Opening into the top of the womb on either side are two small canals (the Fallopian tubes), down which the unfertilized eggs pass to reach the womb. These tubes open out at their free ends into a trumpet-shaped funnel which lies near two oval bodies (the ovaries), each about  $1\frac{1}{4}$  inches long. [Figs. 82, 84, 86.]

The ovaries are the two glands in which the eggs form. [Figs. 82, 86.]

The raised ring of the part of the womb projecting about  $\frac{1}{2}$  inch into the front-passage makes it difficult to pass any instrument directly into the womb. In attempting to pass an instrument into the womb, an inexperienced hand generally encounters the corner formed between the projecting mouth of the womb and the walls of the front-passage. If pressure is then applied to the instrument, the walls of the front-passage will be perforated. [Figs. 82, 83, 84, 86, 87.]

The whole of the front-passage and the part of the womb

which projects into it are covered by a thin moist skin (the mucous membrane). This mucous membrane may undergo structural changes if exposed to the air for some time, as occurs after a descent of the womb (prolapsus uteri). The internal canal of the womb is not in a straight line with the front-passage. The line of the front-passage is backwards; that of the womb is forwards and upwards. The axes are nearly at right angles. [Figs. 83, 84.]

**The Bladder and its Accessories.**—The pipe from the bladder to the outside is a small canal (the urethra),  $1\frac{3}{4}$  inches long, which lies in front of, and is closely associated with, the anterior wall of the front-passage. From its position, it is often bruised in the passage of the child's head during labour. The back and lower parts of the bladder also lie on the front-passage. [Figs. 83, 84.]

**The Back-Passage** is separated on the surface from the front-passage by a small area of skin and muscle called the "perineum." This area, which is about  $1\frac{1}{4}$  inches long, is of some importance, as it forms the floor of the abdomen in this part.

It is frequently torn during labour (ruptured perineum), and the floor of the abdomen being thus weakened, the organs tend to descend. In consequence descent of the womb (prolapsus uteri) frequently occurs. (See below, Disease, Prolapse.) [Figs. 83, 84.]

### Consequences of Accident.

The following are some of the accidents which may happen to the female generative organs, and the parts affected by such accidents:

Injury may happen to—

- (i.) The external parts (the vulva).
- (ii.) The perineum (the space between the front and back passages),
- (iii.) The front-passage (vagina).
  - (a) Foreign bodies.
  - (b) Wounds.
- (iv.) The womb (uterus) and its contents.
  - (A) Unimpregnated.
    - (a) Foreign bodies.
    - (b) Wounds.
    - (c) Backward displacements (retroversion).
    - (d) Downward displacements (prolapse).

## (B) Pregnant.

(a) Wounds.

(b) Separation of the after-birth (placenta).

(c) Abortion, premature labour, or threatened abortion.

(d) Injury to the child in the womb.

## (C) During labour.

(v.) The tubes (the Fallopian tubes).

(vi.) The ovaries.

(vii.) The peritoneum (the internal covering of the organs).

(viii.) The urinary system.

(a) Foreign bodies.

(b) Bladder-pipe (urethra).

(c) Bladder.

(ix.) The back-passage.

(i.) **The External Parts (the Vulva).**—Injuries may occur by bruising, by impalement, or by laceration. The only point to be considered is the risk of bleeding. This is not very grave in healthy persons, nor is there serious risk of infection, and the parts heal rapidly. The usual causes are falls from some height, or breaking of a chair or chamber utensil. There may be some degree of shock. (For injury to varicose veins, see below, Disease—Existing before the Accident.)

*Blood-Tumour, or Hæmatoma.*—A bad bruise may cause blood to be poured out into the loose tissues of these parts, and a blood-tumour to be formed.

(ii.) **The Perineum (the Space between the Front and Back Passages).**—The injury known as “ruptured perineum” is very rare, except as an accident of labour, when it is extremely common. The large child’s head, descending, stretches and tears this space. (For the after-affects, see below, Disease, Prolapse.) [Fig. 84.]

(iii.) **The Front-Passage (Vagina)** [Figs. 83, 84].—(a) *Foreign Bodies.*—These may be introduced intentionally, either by the patient herself or by her medical attendant, or may be due to an accident. Self-introduction by hysterical females is not uncommon, and might lead to an assertion of an accident. These bodies may cause no harm unless they are dirty, or are left in for a period long enough to cause inflammation. The foreign bodies introduced by medical men are called “pessaries,” and

could hardly cause trouble, unless neglected. They are small mechanical contrivances to correct the displacement of the womb.

(b) *Wounds*.—These could occur from penetrating substances, such as the parts of a broken chair, or any object which might enter from a fall.

The commonest cause of injury, however, is labour, in which case the wall of the front-passage (vagina) is injured at the same time as the perineum is torn. Bruising of the vaginal wall is common in labour, and occasionally is so severe as to cause a large blood-collection (*hæmatoma*) to form by the side of the vagina in the loose tissues of the pelvis.

These large blood-collections are not always caused by laceration, but may be the result of rupture of a varicose vein under the skin; but this rupture is only likely to occur in a pregnant woman, and it may or may not be associated with an actual laceration of the wall of the front-passage.

Bruising of the wall may be so severe as to cause impairment of the vitality of a part of the vaginal wall, with subsequent slow mortification (*sloughing*) of the affected part. It is in this way that a hole may be formed through the front wall into the bladder (*vesico-vaginal fistula*), or through the back wall into the back-passage (*recto-vaginal fistula*).

These wounds may heal rapidly, or may remain as permanent holes, requiring operations for their closure. (See below, *Operation*.)

#### (iv.) **The Womb (Uterus) and its Contents.**—

- (A) Unimpregnated.
- (B) Pregnant.
- (C) During labour.

(A) **UNIMPREGNATED WOMB (UTERUS).**—(a) *Foreign Bodies*.—These could hardly be introduced by accident, though they might be introduced by a surgeon or criminal abortionist.

(b) *Wounds*.—Stabs, bruises, or punctures, are all possible, the last not infrequently, through the introduction of an instrument intended to procure an abortion, when in fact no conception has taken place. There is no great danger if the wound is from the inside of the womb, except from inflammation caused by the instrument being dirty. Of course, if the wound is from without, and passes through the wall of the abdomen, as in a homicidal stab, there is a grave risk of peritonitis. (See *Abdomen*, p. 39.)

(c) *Backward Displacement (Retroversion)*.—The womb naturally has a slight twist to the right, and is bent forward a little. There is a form of bending, retroversion, or backward tilting, a condition which is the exact opposite of the normal position, and this produces symptoms. It is extremely difficult to establish the possibility of a backward displacement as a result of an accident. The symptoms are backache, bearing-down pains, a white discharge, and a disturbance of the monthly periods. (See below, Diagnosis.)

(d) *Downward Displacement (Prolapse)*.—This usually occurs some time after child-birth, the womb descending because the normal supports, weakened or distended by the process of labour, have not returned to their normal condition.

Immediately after birth the womb is about as large as a cocoanut, but during the month after it slowly becomes smaller and smaller until it reaches the normal size. Sometimes, for various reasons, it does not get as small as it should, and when the mother begins to get about again, if the supports of the womb remain weak, the womb descends and produces the condition we are discussing. The womb with the walls of the front-passage, which it pulls down with it, descend from their normal position, and occupy a lower level, till gradually they may come completely outside the body. In contrast with the descent of the womb after labour, a descent of the womb as the result of accident is sudden and very severe. The organs sometimes immediately descend completely outside. There will then be very considerable pain, and a feeling of something having given way. Lifting a heavy weight, or a violent squeeze, as in a buffer accident, has been known to cause this condition.

Though very rare, there are cases recorded in which a descent of the womb has occurred after a violent strain, even in women who have never borne children.

In these cases, however, the conditions of the woman who has borne children are to some degree imitated, for the subjects are unhealthy, badly nourished women, with the supports of the abdomen weakened by ill-health, and consequent loss of muscular tone.

When the womb is completely outside the body, it has dragged down with it the bladder, tubes, ovaries, as well as the walls of the front-passage. If the womb remains in this prolapsed condition, changes in the skin covering it take place, leading to thickening and hardening.

(B) THE PREGNANT WOMB AND ITS CONTENTS.—(a) *Injuries to the Womb itself.*—The womb may be pierced by stabs, goring by bovine animals, gunshot wounds, or other like accidents. It may burst by great violence, as in squeezing in a buffer accident. Any of these injuries to the womb may produce profuse and even fatal bleeding.

On the one hand, the shock to the woman may be so great as to cause death. On the other hand, if the wound be small and does not become infected, there may be little evil consequence. Miscarriage is the commonest consequence, but leaving that out, the great danger will be from peritonitis—that is, if the bleeding be not immediately fatal.

(b) *Separation of the After-birth (Placenta).*—An accident such as a sudden shaking, a fall, or a slip, may lead to the partial separation of the womb from its contents. Blood may collect inside the womb under the after-birth, and may spread and escape, causing bleeding from the front-passage (vagina). On the other hand, no blood may escape at the time; there may or may not be pain; and the baby may be born at full time, and then an old clot will be found at the site of the partial separation of the after-birth. The symptoms are much the same as threatened premature labour or threatened abortion. In fact, separation of the placenta is one of the causes of abortion or premature labour, though that unfortunate result is not always a sequence.

(c) *Abortion, Premature Labour, and Threatened Abortion.*—From time immemorial it has been the custom to account for miscarriage by accidental circumstances. How far this is true, and what is the real importance of the accident, is not always easy to establish. Abortion is likely to occur in cases in which the mother or the child is syphilitic, or where the mother has uterine congestion. This uterine congestion may arise either from displacement or from pre-existing inflammation, affecting the uterus, tubes, ovaries, or inner skin (peritoneum) lining the abdomen. Congestion is also common in kidney, heart, or liver disease, and in some fevers, such as typhoid, pneumonia, scarlet, smallpox, etc. Therefore it is clear that all women subject to the above diseases are predisposed to miscarry if they become pregnant. In such cases accidents of the most trivial character will cause abortion, such as tripping over a step, falling upstairs, or sudden emotion. On the other hand the question arises, Will an accident cause abortion in an otherwise healthy individual?

Though of very rare occurrence, it must be admitted to be possible, for there are recorded cases in which abortion has occurred as a result of accidents in women, in whom no evidence or symptoms of pre-existing disease had been recognized. (See Diagnosis.) It is also known, on the other hand, that the pregnant womb is extraordinarily tolerant of injury.

For instance, there have been cases of stabbing or gunshot wounds in the abdomen in pregnant women without abortion resulting. Also it is a matter of common medical knowledge that severe abdominal operations may be performed without any evil effect to the pregnant womb. The medical man must direct his attention in every case to ascertaining the presence or absence of pre-existing disease which might predispose to abortion. He must then weigh the amount of responsibility for the abortion to be assigned to the accident. The same remarks apply to premature labour; but it must be borne in mind that it may be caused by diseases in the mother, such as heart disease, kidney disease, or a form of convulsions which occurs in pregnant women who have kidney disease, called "eclampsia."

Premature labour—*i.e.*, expulsion of a child that can live—is sometimes started by separation of the after-birth (the placenta) from its attachment to the womb, setting up bleeding and uterine contractions. Bleeding is sure to occur in the condition known as "placenta prævia," where the placenta, instead of being in its normal place, forms over the mouth of the womb. In such a case the separation, though being inevitable, from the dilatation of the womb during labour, bears no relation to any accident. In some cases, however, a normally situated placenta may become more or less detached; this is quite commonly the result of some accident, but it is not invariably so. It can often be shown that the patient was predisposed to such an occurrence by some pre-existing disease of the uterus, such as chronic inflammation. The part played by the accident in such a case would have to be determined by a general survey of the case.

Threatened abortion or premature labour shows itself by two symptoms—namely, pain, due to the contractions of the womb trying to expel its contents, and a bleeding from the womb through the front-passage (vagina). These symptoms, however, may be caused by disease of the womb, such as new growths, polypi, inflammation, etc., and therefore the presence of the pregnancy must be established before a threatened abortion can be diagnosed. It is not necessary that the womb

should empty itself even after it has shown these symptoms, if appropriate treatment be adopted. Hence we can conceive a case where a threatened abortion was hastened and made inevitable by some accident over which the patient had no control. This would create a very difficult medical situation, in which it would be impossible to be certain whether a threatened premature labour or abortion had become inevitable before the accident or not. Under such conditions it would be a great responsibility and an almost insuperable difficulty to gauge the part played by the accident in causing abortion or premature labour which was already threatening at the time of the accident.

(a) *Injury to the Child in the Womb*.—Accidents have been known to injure the child, but various forms of distortions, and even amputations, occur to children without any history of accident.

Where the child has been injured by stabs, gunshot wounds, blows, etc., the womb is injured at the same time, and therefore the mother is rarely able to continue carrying the child, which is in consequence born prematurely. A kick or a blow has been known to kill the child without injuring the mother severely.

(C) DURING LABOUR.—*Rupture of the Womb*.—The common accidents to the pregnant womb are those which occur during labour, and are to be classified under the heading of Rupture of the Womb and Tears of the Walls of the Womb.

These accidents may occur during delivery as a result of natural causes, and then no blame can be attached to a medical man or midwife, although, on the contrary, such accidents may be the result of improper treatment.

*Puerperal Fever*.—See below, Disease.

(v.) **The Tubes** [Figs. 82, 84, 85, 86].—This could hardly arise except they were diseased. (See below, Disease—Existing before the Accident.)

(vi.) **The Ovaries** [Figs. 82, 84, 85, 86].—The ovaries are very unlikely to be injured by any except very severe accidents, and could then only share in some much wider injury. Practically they cannot be injured alone. Inflammation of the ovaries is always the result of infection. Occasionally they are displaced, and thereby rendered more liable to injury.

(vii.) **The Peritoneum** [Figs. 85, 150, 151, 152] (the Lining of the Abdomen and Covering of the Womb).—Stabs and wounds which penetrate the abdomen will injure the peritoneum. The actual injury is unimportant; but the risk of subsequent



inflammation (peritonitis) is very great, and may be a fatal complication. (See Abdomen, p. 39.)

(viii.) **The Urinary System** [Figs. 83, 84]—(a) *Foreign Bodies*.—Foreign bodies are sometimes introduced by hysterical girls into the passage to the bladder. They might be the subject of an allegation of having been introduced by accident, and might perforate the bladder wall. (See below, Diagnosis.)

(b) *The Bladder-Pipe (the Urethra)*.—The pipe from the bladder lies embedded in the front wall of the front-passage (vagina). It may be injured by any accident which can harm the front-passage. (See above, Injury to the Front-Passage.) [Figs. 83, 84.]

Even if the wall of the vagina recovers, and inflammation does not lead to the formation of a hole through into the bladder, the result may still be a difficulty in holding the water—incontinence of urine. (See below, Diagnosis.)

(c) *The Bladder*.—The bladder wall may be so very severely injured that mortification may ensue, and leave a hole between the front-passage and the bladder (vesico-vaginal fistula).

(ix.) **Injury to the Back-Passage**.—A hole may be formed between the front-passage and the back-passage (recto-vaginal fistula) in consequence of an injury to the front-passage. (See above, Injury to Front-Passage and Intestines.) [Figs. 82, 83, 84.]

## Disease.

### i. Produced by the Accident.—

- (i.) External parts (the vulva).
- (ii.) Perineum (the space between the front and back passages).
- (iii.) Front-passage (vagina).
  - (a) Foreign bodies.
  - (b) Disease of the walls caused by injury.
- (iv.) Womb (Uterus).
  - (A) Unimpregnated.
    - (a) Foreign bodies.
    - (b) Wounds.
    - (c) Displacements.
  - (B) Impregnated, but independent of labour.
  - (C) After injuries and infections during labour.
- (v.) Tubes.
- (vi.) Ovaries.
- (vii.) Peritoneum.
- (viii.) Urinary system.

(i.) **The External Parts (Vulva).**—Disease here can only be the effects of an inflammation produced either by the micro-organisms, which form matter and an abscess, or by those which produce widespread inflammations, such as erysipelas and general blood-poisoning. Infection is particularly likely to occur where any blood-collection has formed in the outside parts (vulva), or has formed under the lining of the front-passage (vagina), with or without a laceration leading to the exterior. The infection by microbes of these large blood-collections is likely to produce serious results, a prolonged discharge of matter (suppuration) producing grave results, or even fatal blood-poisoning.

(ii.) **The Perineum** (the Space between the Front and Back Passages).—The only disease that results from injury here is permanent weakness through non-union of a tear after confinement. The effects are found under the head of Prolapse of the Womb. Although incontinence of the contents of the bowels may follow, gradual prolapse of the womb is usually the only troublesome symptom.

(iii.) **The Front-Passage (Vagina)** [Figs. 83, 84].—(a) *Foreign Bodies.*—Foreign bodies in the front-passage are usually pessaries—that is, instruments placed in that situation for the relief of a displacement of the uterus. They may cause some discharge, but if properly looked after and removed for cleansing sufficiently often they lead to no serious disability. In some cases ulceration has been known to follow their use, even ulceration into the bladder, causing a fistula. This, when it arises, is always the result of negligence on the part of the patient; for instructions are always given as to how often these pessaries should be removed (the removal is generally done by a medical man), and it is neglect of these instructions which leads to the evil consequences.

Foreign bodies other than pessaries are usually introduced by the patient, and may cause tearing and subsequent infection of the walls, and other after-effects.

(b) *Disease of the Wall caused by Injury.*—Injuries to the wall of the front-passage may produce wounds which become infected by micro-organisms and form matter (pus). Such wounds may lead to stricture or narrowing of the passage. If the injury be sufficiently severe, deep ulceration and local mortification, as has been already mentioned, may occur. This accident is extremely rare, and is usually then an accident of labour. When a narrowing or stricture of the passage occurs, the result

is an impossibility of performing the marital functions; and when complete closure follows, the result is a retention of all the uterine secretions (the blood of the monthly periods). Should pregnancy occur with a narrowed canal, it may be impossible for the child to be born *per vias naturales*, and the operation of Cæsarean section, or opening of the womb through the abdomen, may have to be performed.

The injury may produce holes into either the bladder or the back-passage. (See below, Injury to the Urinary System.)

(iv.) **Disease arising in the Womb (Uterus)** [Figs. 82-87].—  
(A) UNIMPREGNATED WOMB, caused by—

(a) *Foreign Bodies.* (b) *Wounds.*—Disease caused by these can only be the result of infection of a wound, and occurs very rarely as the result of common accidents, as it would be hardly possible for the unimpregnated womb to be severely injured except as a part of a much more serious accident to the pelvic organs.

(c) *Displacements.*—The two displacements mentioned above under the head of Accidents to the Womb, which are backward displacement, or retroversion, and downward displacement, or prolapse, remain frequently as permanent disease with a continuation of their symptoms. It must be remembered that, though displacements are of frequent occurrence, they are exceedingly rarely the result of accident. Retroversion is most common as a congenital defect without any accident at all, and prolapse commonly occurs as a gradual process after confinement without the intervention of any accident. (See below, Diagnosis.)

(B) IMPREGNATED WOMB.—Injuries to the pregnant womb leave no disease apart from that due to infection. This may occur at the time of the accident, or laceration of the womb due to the accident may become infected later—*i.e.*, after the womb has emptied itself of its contents. The question arises in such a case whether the infection has anything to do with the injury, or whether it has occurred as a result of miscarriage, and is therefore the commencement of “puerperal fever.” Again, the womb may not return to its normal size, weight, and consistency, after a miscarriage which was the result of an accident. This is known as “subinvolution.” The question naturally arises whether the subinvolution has anything to do with the injury. (See Diagnosis.)

(C) DISEASE CAUSED BY INJURIES AND INFECTIONS DURING LABOUR.—Injuries affecting the following parts during labour

are all mentioned under the head of Consequence of Injury:

- (i.) The external parts (the vulva).
- (ii.) The perineum.
- (iii.) The front-passage (the vagina).
- (iv.) The womb.

*Puerperal Fever.*—An infection starting from the female generative organs as a result of labour or abortion. It is a common disease, and may follow obvious injury, or may start in cases where there has been no such injury.

Minute lacerations occur in every labour, and any one of these may be sufficient to allow the entrance of germs, which will set up an infection. The source of the infection can rarely be traced, for it may occur in cases where there has been no internal examination made, and no instruments used at any time during labour.

If due care is taken by an attendant to disinfect the hands, or any instruments or appliances used, no blame should be attached to him for an infection which may occur.

There is always a possibility that the germs causing an infection were located in the front-passage of the patient before the labour commenced.

Even if it were proved that an attendant went straight from a case of erysipelas, blood-poisoning, or another case of puerperal fever, to a lying-in woman, it would be impossible to attach blame to him if an infection occurred, provided he had adopted modern methods to disinfect his hands and appliances.

The same remarks apply to infections after abortions, or after operations undertaken by a surgeon on the female generative organs. (See below, Diagnosis.)

(v.) **The Tubes** [Figs. 82, 84, 85, 86].—The tubes very often become diseased and inflamed, and this may be accompanied by peritonitis. Such inflammation is practically unknown as a part of an accidental injury, but might follow an infection of the womb after a miscarriage, labour, or gonorrhœa.

(vi.) **The Ovaries** [Figs. 82, 84, 85, 86].—Diseased ovaries are exceedingly common, without any suggestion of an accident. The ovaries can only become displaced as a part of a backward displacement of the womb. The condition is spoken of as prolapse of the ovaries. It is a permanent condition as long as the womb remains displaced. (See below, Disease—Existing before the Accident.)

(vii.) **The Peritoneum** [Figs. 84, 150, 151, 152]—Peritonitis, or inflammation of the covering skin of the abdominal and pelvic organs, is usually set up by infection, and is common without any accident. It frequently follows disease in the female organs, especially the Fallopian tubes and womb. It may occur after a wound, and may be fatal. The inflammatory substance produced in peritonitis around and between the abdominal organs may lead to adhesions between the womb, bladder, rectum, ovaries, tubes, intestines, etc., with fixation of the organs, interference with their functions, and continued illness. (See below, Diagnosis.)

(viii.) **The Urinary System** [Figs. 83, 84].—(a) *Foreign bodies* introduced into the bladder through the urethra may cause disease leading to—

Inflammation of the bladder.

Perforation of the bladder, followed by the widespread escape of urine into the tissues, and possibly into the abdominal cavity, producing peritonitis.

Formation of a nucleus, around which a bladder-stone may be deposited.

(b) *Disease arising from injury to the urine-pipe* (the urethra) may cause—

Incontinence of urine. (See Diagnosis.)

An abnormal communication between the urine-pipe (urethra) and the front-passage (vagina).

An inflammation of the urine-pipe (urethra).

Any of these injuries may set up an inflammation which may spread up the pipe leading from the kidney to the bladder, and matter (pus) may form in the kidney, and in consequence suppression of urine, blood-poisoning, etc., may supervene and cause death.

2. **Existing before the Accident and aggravating its Effects.**—Any diseased condition of the female generative organs, whether it be abscess, prolapse, tumour, varicose veins, tuberculosis, or cancer, may be rendered worse by accidents.

The following are the special features which may be noted :

**Tuberculosis.**—Tubercle of the generative organs is governed by the same laws that govern tubercle elsewhere in the body.

An accident may seem to spread the malady, but the usual course of this disease, when it affects the female organs, is that it in any case sooner or later spreads to the skin lining (the

peritoneum) of the interior of the body, and causes tubercular peritonitis without the intervention of any accident.

**Tumours; Abscess.**—The ovaries are peculiarly liable to tumours of various kinds. The tubes (the Fallopian tubes) from the ovaries to the womb often become filled with matter (pus).

Ovarian cysts are a common form of tumour, and some of them have a long stalk or pedicle. Abscesses form in the pelvis in consequence of disease.

**Extra-Uterine Pregnancy.**—There is a rare form of pregnancy, where the child is developed, not in the womb, but in the tube to the womb, it being fertilized by the male element before it reaches the womb. This is called an “extra-uterine pregnancy,” and is one of the most dangerous conditions that can happen to a woman. It might be claimed that rupture of the tube containing the child was due to an accident, but this rupture happens in the usual course of events, is sometimes fatal, from internal bleeding, and requires no accident to cause it.

Bleeder’s disease (hæmophilia), where the smallest injury tends to bleed excessively, must be referred to; but there is no special feature in this disease as regards the female generative organs.

**Gonorrhœa and Syphilis.**—Infection of the generative organs is very common, as a result of the communication of venereal disease (gonorrhœa or syphilis). The results of a gonorrhœal infection may be widespread, and may include inflammation of the outside parts (vulva), front-passage (vagina), womb, tubes, ovaries, and peritoneum.

From these infections a fatal result may occur, even without any accident, but the diseases may be lighted up by an accident.

### Operation.

Certain operative procedures become necessary as a result of accidents, but, with the exception of those involving the opening of the abdomen, they are not very serious, and do not expose the patient to any particular risk.

(i.) **The External Parts.**—Blood-tumour (hæmatoma) of the vulva may require incision and drainage or incision and removal of contents. The only risk is that of infection, which is slight, but inseparable from all operations of this nature.

(ii.) **The Perineum** (the Space between the Front and Back Passages).—In the case of a perineum ruptured during labour, the rupture should be stitched up immediately after delivery, and then if it heals healthily there will be little or no trouble.

Operations for the cure of an old rupture of the perineum are devoid of any special risk, but are apt to fail, and may have to be repeated.

(iii.) **The Front-Passage (Vagina)** [Figs. 83, 84].—Foreign bodies may require removal under an anæsthetic, or the parts may have to be cut to facilitate removal. Practically, there is no risk in these procedures, provided the foreign body has not produced an ulceration which is on the point of opening into the bladder or rectum. Narrowing of the front-passage can be relieved by an operation of grafting a piece of new skin to add to the area of the walls of the passage.

Operations for the closure of a recto-vaginal or vesico-vaginal fistula have no special risk, but are still more liable to fail than perineal operations. The reason, of course, is obvious: the wounds are bathed with the bowel or bladder contents, and consequently do not heal well, and thus further operations may be necessary.

(iv.) **The Womb (Uterus)** [Figs. 82-87].—(a) *Unimpregnated*.—The operation for displacements of the womb is not serious. That for descent of the womb usually only concerns the front-passage, and has no special danger. For bending back (retroversion) of the womb, the abdomen sometimes has to be opened; but the risk here is small, and only at all serious if unforeseen complications, like inflammatory diseases of the ovary and tube, have to be treated as well.

(b) *Pregnant*.—In injuries to the pregnant womb the abdomen must be opened in order to deal with the effects of stabs, gores, impalement, etc., and here there is a great risk to life. This is not so much from the operation itself, as from the fact that these wounds are usually already infected, and the patients are often in a condition of collapse or shock. This combination of adverse conditions is a very serious one to overcome. Hence here is always a great risk of a fatal result whether an operation is undertaken or not.

(c) *After Labour*.—The sections i., ii., iii., above mention operations which may be required after injuries received during labour, but, in addition, the womb itself may be ruptured, which is a most serious accident and demands a difficult operation. The abdomen may have to be opened and the wound dealt with, but shock, bleeding, or peritonitis often prevent the operator having a chance to succeed.

(v.) **The Tubes.** (vi.) **The Ovaries** [Figs. 82, 84, 85, 86].—Operations are never required for these organs for simple

accident uncomplicated by disease. For the operations for diseases of these parts books on gynæcological surgery should be consulted. The operations are too numerous to be referred to here. The operations for such disease conditions as rupture of an ovarian cyst, torsion of the stalk or pedicle of an ovarian cyst, and rupture of a tube in which pregnancy has occurred (tubal gestation), are always very serious. The risk, however, is due to the disease itself, and not to the actual operation.

(vii.) **The Peritoneum** [Figs. 84, 150, 151, 152].—For operations on the peritoneum, see Peritoneum (p. 617).

(viii.) **The Urinary System** [Figs. 83, 84].—Laceration of the bladder-pipe (urethra) may necessitate reconstruction of the tube by stitching. This is by no means a serious operation, though at the first attempt the result may not always be satisfactory.

### Cure.

Of all the subjects connected with injuries to women, the time for surgical cure is the most difficult to estimate. So much depends upon the degree of injury and the possible duration of its effects.

(i.) **The External Parts (Vulva)**.—A blood-tumour may be slowly absorbed, but if infection occurs matter (pus) may form and give trouble. With this exception, an injury to these parts heals quickly, and leaves no troubles unless there is considerable destruction of tissue, with subsequent narrowing from cicatrization of the outlet of the front-passage (vagina) or of the bladder-pipe (urethra).

Laceration of the vulva or vagina heals rapidly if not infected, and when healed leaves no permanent disability. Work can be resumed at once.

(ii.) **The Perineum** (Space between the Front and Back Passages).—Injury to the space between the front and back passages is rare except in labour. If the rupture is at once stitched up and heals healthily, it should be cured in about three weeks. Unhealed it is the greatest cause of trouble to married women. Descent of the womb, with all its train of troubles, may result, and a surgical operation may be necessary to restore the broken supports to their normal condition.

Ruptured perineum, when properly repaired by operation, should heal in three weeks, and the patient should be ready for work in about six weeks. When the operation has been performed as a part of the cure for a descent of the womb, the



same time limit for healing must be allowed, and the patient will not be able to do any heavy work for a long time.

(iii.) **The Front-Passage (Vagina)** [Figs. 83, 84].—This may heal rapidly and completely, but long-continued inflammation may leave scars. These scars contract, as is usual, and a narrowing of the front-passage is produced. This is a permanent condition unless relieved by a skin-grafting operation. Holes through into the front or back passages, if they do not immediately heal up, may require operations to close them by stitching. If these operations succeed, healing occurs in about six weeks, but further operations may be necessary.

Contraction of the vagina due to scars does not leave any incapacity for work, but prevents the resumption of marital relations. Hence operations must sometimes be done to try and widen the canal. The results are not very satisfactory in the recorded cases.

(iv.) **The Womb (Uterus)** [Figs. 82-87].—(a) *Unimpregnated*.—Simple injury of the nature of a clean puncture will heal in a few days. Infection, however, is likely to occur, and then, if the patient does not die, the cure may be slow.

(b) *The Pregnant Womb*.—Injuries, if not fatal at once, may heal in a month or six weeks, so as to leave no permanent disability. In such cases, if there has been any formation of matter (suppuration) in an abdominal wound, there is some risk of the yielding of the scar later. (See Rupture—Post-Operative Hernia, p. 693.)

Abortion and premature labour may be said to cure themselves by discharge of the contents of the womb, though a tardy return of the womb to its normal condition (subinvolution) may prolong the period of convalescence for a variable time, sometimes three months. Displacements of the womb may cause long-continued trouble; but in general a well-corrected retroversion will produce no permanent disability.

A prolapse may render the patient unfit to perform any hard work for a long period of time. The results of prolapse of the womb may be modified by properly planned operations, but no period can be fixed for cure.

(c) *After Delivery*.—No time can be given for union of a ruptured womb. It may be months before the patient is well.

(v.) **The Tubes**.—See Disease.

(vi.) **The Ovaries**.—See Disease.

(vii.) **The Peritoneum** [Figs. 84, 150, 151, 152].—When in consequence of injury the peritoneum becomes inflamed, a most grave condition has arisen. The healing is very slow, and after the disease has ceased to be active, bands of inflammatory fibrous tissue frequently remain; these, by contracting, twist the womb, the tubes, and ovaries, out of their places. This produces pain, backache, white discharge, and perhaps sterility. (See Peritoneum, p. 616.)

(viii.) **The Urinary System** [Figs. 83, 84].—Incontinence of urine caused by injury to the bladder-pipe (urethra) is most intractable.

Incontinence of urine may or may not prevent a patient performing her usual work. Much depends upon whether it is only nocturnal incontinence or whether no urine can be retained at any time. The latter probably prevents a woman doing any but the lightest work. The question of cure depends upon the possibility of a good result from some operation.

### Return to Work.

(i.) **The External Parts.**—As soon as surgical cure is complete the woman may return to work.

(ii.) **The Perineum** (the Space between the Front and Back Passages).—After the operation for simple repair of an old rupture of the perineum, the patient should be able to return to work in six weeks. If the operation for repair of a ruptured perineum has been performed as part of the cure of a descended womb, the period at the end of which work may be resumed cannot be fixed, and may be of long duration.

(iii.) **The Front-Passage (Vagina)** [Figs. 83, 84].—*Injury to the Walls.*—Simple scratches and tears healing rapidly do not retard the woman from returning to work as soon as they are healed.

If a tear occurs through into the front or back passage, then as soon as the hole is healed the woman can return to work. (See above, Cure.)

Narrowing of the vagina due to scars does not cause any incapacity for work.

(iv.) **The Womb (Uterus)** [Figs. 82-87].—(a) *Unimpregnated.*—Retroversion would not, as a rule, prevent a woman from working.

A prolapse may render the patient unfit to perform any hard work until it is cured.

(b) *The Pregnant Womb*.—Injuries to the pregnant womb heal rapidly unless they are fatal or start peritonitis. Even after simple rapid healing the woman should not return to work for eight to ten weeks.

*Miscarriage or Abortion*.—The time for return to work will be about a month, unless subinvolution occurs. (See below.)

(c) *During Labour*.—See above, Cure.

(v.) **The Tubes**. (vi.) **The Ovaries**. (vii.) **The Peritoneum**.—There is no time that can be fixed in these cases. (See above, Disease and Peritoneum.)

(viii.) **The Urinary System** [Figs. 83, 84].—Incontinence, if of the daily variety, will prevent a woman from working. (See Cure.)

(ix.) **The Back-Passage**.—See above, Injuries to the Front-Passage.

### Recurrence.

Recurrence of the consequences of an accident can hardly occur in the case of any wound which has once healed, except in the case of failure of operations to cure deformities. For instance, a contraction of the vagina due to scars may heal completely, leaving a mere narrow track or pipe leading from the uterus to the outside. An attempt to open this up and line it with skin may fail, and lead to recurrence of the contraction. A wound in the bladder or back-passage (rectum) once healed is not likely to break down again.

A displacement of the womb once produced is exceedingly likely to recur—in fact, is very seldom absolutely cured. This is particularly so with prolapse. The good results of operations for prolapse may be undone by an injudicious straining effort.

Abortion is apt to recur, but as a rule such recurrent abortions are due to disease, such as uterine congestion and syphilis, not to accidents.

### Occupation Diseases.

Practically, there are no occupation diseases in connection with the female generative organs.

There is a law which prevents a woman resuming work in a factory within a month of giving birth to a child.

### Diagnosis.

(i.) **The External Parts**.—Injury to the outside parts must be distinguished from diseased conditions resulting in ulceration, new growths (cancer), venereal sores, or inflammatory processes.

In general it may be said that recent injuries present sharp-cut or lacerated edges, with bruising and blood-effusion on the wound surfaces or under the skin. Older injuries present velvety granulating surfaces, often secreting matter (pus), and having the usual appearance of healing wounds. The diseased conditions above mentioned leave their own characteristic appearances and general symptoms, and the history of them will be different from that of injuries.

(ii.) **Perineum** (the Space between the Front and Back Passages).—Injury to the perineum is commonly the result of labour, but may be caused by a common accident (impalement, etc.). The signs of recent delivery will usually indicate the cases due to labour.

(iii.) **The Front-Passage (Vagina)** [Figs. 83, 84].—The remarks above on the outside parts apply to recent injuries to the walls of the front-passage.

The after-effects of injury to the front-passage are—

- (a) Perforation from the front-passage (vagina) into the bladder.
- (b) Perforation from the front-passage (vagina) into the back-passage (rectum).
- (c) Contraction or obliteration of the passage due to scars.

(a) *Perforation from the Front-Passage into the Bladder.*—Perforations of the bladder may be due to direct injury by sharp articles, in which case the edges of the wound appear clean-cut or lacerated. These perforations are, however, usually caused by mortification of the parts due to prolonged pressure during labour. They then have granulating edges, and the history of a prolonged labour will usually help in the diagnosis. In the case of an old perforation into the bladder, the evidence of a medical man who attended at a previous confinement may reveal the cause of the injury.

(b) The same remarks apply to *perforation into the back-passage (rectum)*.

(c) *Contraction or Obliteration of the Front-Passage due to Scars.*—This may be the result of a common accident or of labour, but in some instances it is a congenital malformation—namely, entire absence of the front-passage, or closure of the lower end or of some other part of the front-passage.

In congenital cases the parts will present no granulating surfaces, and no sign of any old or recent injury. In some of

these the retention of menstrual secretions may help in the diagnosis. The existence of a previous labour shows that such narrowed conditions must have been acquired.

If the fact that they are acquired can be established, evidence must be offered to determine whether they are the result of labour or of a common accident.

(iv.) **The Womb (Uterus)** [Figs. 82-87].—(A) UNIMPREGNATED: (a) Foreign bodies; (b) wounds; (c) displacements backward—retroversion; (d) displacements downward—prolapse.

(a) *Foreign Bodies*.—The length of time may be indicated by some incrustation on the foreign body.

(b) *Wounds*.—The unimpregnated womb can only be directly injured by stabbing, impalement, etc., and as a rule can never be injured alone, on account of its situation. The diagnosis in that case would only be important as to the actual cause of the injury. The commonest injury to the womb is splitting of the mouth and neck during labour, and this condition might conceivably have to be distinguished from injury due to accident.

(c) *Displacement Backward*.—Displacements of the womb are sometimes stated to be the result of accidental circumstances, although the common cause of these conditions is labour and abortion, combined with injury to the supports of the organ, to the pelvic floor in particular. The two common forms of displacement are: retroversion, or backward displacement; prolapse, or downward displacement.

In a medico-legal sense it is extremely difficult to establish the possibility of a backward displacement as the result of a common accident. In dealing with such cases it must not be forgotten that the common symptoms complained of by women who have displacements may not necessarily be caused by the displacement. The symptoms attributed to displacement—backache, bearing-down pains, troubles with their monthly periods—may all be due to other causes.

Some of these symptoms would occur in lumbago, sciatica, kidney disease, bone disease, nervous disorder. They are especially common in anæmia when it is associated with a white discharge, commonly known as “whites,” which may be due to simple anæmia, or the infection from the organism of gonorrhœa or other germs.

In many instances it may be that there is no attempt to fix the responsibility of these troubles on a second party, but occasionally these patients bring actions for damages, and then the difficulty of diagnosis is greatly increased.

The whole subject turns on the question, Did the displacement exist before the accident or not?

No case has hitherto been definitely brought to our notice in which it could be clearly proved that a backward displacement was caused by an accident.

The fallacies in connection with these displacements are so many, that they will always afford argument against the woman's story.

To enumerate them—

(a) The womb may be so movable that one day it is in a normal position, and another day displaced. This may be used as an argument even against the very existence of the displacement.

(b) Any woman who has had a child or miscarriage may acquire a backward displacement which gives no symptoms.

(c) Such symptomless displacements may cause symptoms sooner or later as a result of infection or congestion of the womb.

(d) A single woman may have a backward displacement which is usually congenital, and discovered by chance during the course of her examination by a medical man. It may cause no symptoms.

(e) A single woman with a congenital displacement may acquire symptoms as the result of infection or congestion of the womb.

(f) It is stated that a single woman may acquire a backward displacement from long-standing overfilling of the bladder.

These assumptions are practically unanswerable, and will account for so many cases of backward displacements that very few remain in which common accidents appear to play any part.

A displacement which causes symptoms is a permanent condition due to changes in the texture of the womb itself and of its supports, and although it can be replaced by manipulation, it usually goes back into its bad position if left alone.

It is difficult to see how any accident can cause a permanent backward displacement of the womb, as these textural changes require a considerable time to develop.

The sense of something "giving way" inside, so often mentioned by those complaining of these conditions, is common alike to both men and women under conditions of strain. It does not necessarily mean any real breaking of an internal structure.

If something really did give way as a result of a strain or overreaching, there would be some internal bleeding as a result of the break.

We have not been able to find any case on record in which backward displacement has been caused suddenly, accompanied by internal bleeding.

A suddenly produced permanent displacement must be looked upon as a dislocation, and therefore must be attended with the usual signs of dislocation. These we do not find in the backward displacement of the womb. The displacement of the womb with which a woman is born, or acquires in childhood, what is known to doctors as a "congenital displacement," has certain characteristics which enable us to distinguish it from one acquired later in life.

The womb is always smaller than usual, with a small neck, and there is also a shortening of the back wall of the front-passage. The monthly periods are usually painful and scanty, instead of being excessive, as they are in an acquired displacement. Also in congenital cases the womb cannot be kept in the normal position, even though sometimes it may be replaced by manipulation.

The womb usually shows changes which can be traced to its prolonged displacement, because a displacement usually causes obstruction to the bloodvessels. The changes that are found in the womb as the result of congestion are shown by enlargements of the womb, particularly by lengthening of its neck, by alterations in its texture, and by disorders of the monthly periods, such as excessive loss. A suddenly displaced womb should show none of these changes at once, but might acquire them later.

(d) *Downward Displacement (Prolapse)*.—As has already been said, descent of the womb (or prolapse of the uterus) is usually caused by childbirth, the womb descending because the normal supports have been weakened or stretched by the process of labour, and by the subsequent return or non-return of the womb, etc., to their normal condition. Descent of the womb when the result of an accident is sudden and very severe; the organs may even come completely outside. And, moreover, the womb shows no results of chronic congestion, such as overgrowth and lengthening of its neck.

There will be no ulceration of the parts descended and exposed, and the smooth lining of the front-passage (the vaginal mucous membrane) will not be converted into a harder

surface like outside skin; whereas in an old prolapse the surface will be hard, often ulcerated from friction or irritation, and the parts of the womb that are exposed will be larger and longer than normal as the result of long-standing congestion of the bloodvessels from pressure upon them.

From these symptoms a medical man, if called in immediately after the descent of the womb, can usually form a clear opinion as to whether it is of recent occurrence or not.

When a patient is known to have a descended womb, and complains that this has been made worse as the result of an accident, such as lifting a heavy weight or being subjected to a squeeze, there will be great difficulty in proving or disproving her statement. The points to be considered will be—

(a) The degree to which the womb has descended after the accident compared with its former position, if that should be known to a medical man.

(b) The presence of some symptom which was not felt before, such as inflammation of the bladder (cystitis).

The first will be a matter of opinion, as the degree of prolapse is always difficult to estimate. The second might be caused by disease in no way connected with an increase of the descent of the womb. It would require very definite medical evidence to establish the fact of a descent of the womb having been made worse as a result of an accident.

*Descent or Prolapse of the Womb without Pregnancy.*—Though exceedingly rare, there are cases of prolapse on record, in virgins and childless married women, where the causes above mentioned could not operate. In a proportion of these cases the condition is said to be caused by some very heavy strain in lifting, by a squeeze as in a buffer accident, by falls from a height, by blows, kicks, etc.

The strain from lifting is the most common cause. It can, however, rarely be said that the subjects of these accidents are absolutely healthy. As a rule they are bloodless, badly nourished, badly housed, and overworked individuals, women in whom the supporting tissues of the body are weakened or stretched, and hence the displacement of the womb is at least predisposed to. Such individuals may acquire a slowly produced prolapse having no relation to any definite strain. They then resemble the cases caused by labour; only they have no actual contributory injury of the floor (perineum) of the abdomen. The womb and vaginal walls descend because all their supports are weak, and not actually injured.



**(B) PREGNANT.**

*Abortion or Premature Labour.*—The gravest suspicion should always be attached to an assertion that slight accident has caused abortion or miscarriage.

These two have been fully discussed above; there is nothing special in their diagnosis. If a woman has been known to abort regularly at a certain date of pregnancy, as many women do, then the presumption of a repetition of the abortion being caused by the accident is not strong.

Abortion is so exceedingly common when caused by disease of the uterus or diseased ovum, that the part played by an accident is always difficult to appraise.

There is no special feature in an abortion by which positive evidence can be given that it has or has not been caused by accident. Uterine congestion and syphilitic disease are the commonest causes of abortion, and signs of these diseases should be carefully sought for before giving an opinion.

*Injury to the Child in the Womb.*—Injury to the child would have to be diagnosed from the malformations which occasionally occur in the womb apart from any accidental circumstances. Developmental abnormalities of the child are well known, and easily recognized by a medical man. Recent injuries would produce their usual appearances elsewhere than in the child alone. Here, however, a fallacy might arise; for injuries sometimes arise during birth which could not be ascribed to accident, although it might be very difficult to say how such injuries were caused.

**(C) DURING LABOUR.**—Errors of diagnosis could hardly be made by competent medical men.

**Malingering.**

The woman complains she has had an accident, when in fact she has had none, or the accident was trivial and produced no results known to the woman. Or she persists that she is still suffering from the effects of an accident, when in fact she is well.

(i.) **The Outside Parts.**—A recent injury to the outside parts could not be distinguished as to cause, but an ulcer can be clearly distinguished from a recent wound. A recent tear of the skin will show the raw sharp edges without any thickening, and sometimes blood-stains.

An ulcer is often hard, for ulcers of the external genital organs, even when not syphilitic, easily become rather hard, the hard-

ness being due to slowness in healing. An old ulcer has a bluish edge, a thin margin of healing skin spreading the centre of the raw spot.

(ii.) **The Perineum.**—See Diagnosis.

(iii.) **The Front-Passage (Vagina).**—Foreign bodies are occasionally introduced by women, especially hysterical girls, and the only point about them is that the girl might say a medical man had introduced them. Their unusual nature would indicate their origin, especially as they are often hairpins. Cases have occurred where bleeding from the front-passage has been complained of in which, after careful watching, the bleeding has been found to be the result of a pin-prick. This is true malingering. Such bleeding may be alleged to be from a pregnant womb and the result of an accident. An examination would first be necessary to determine whether there was pregnancy or not.

*Old Injuries to the Front-Passage.*—These are occasionally offered as recent injuries, but as the scar tissue takes some time to grow and thicken, it would be necessary to allege the accident happened some time ago.

(iv.) **Womb (Uterus) Displacements.**—(A) *Unimpregnated.*—This lets in two features, one being pure malingering of having had an accident alleged to be the cause of what is really an old-standing disease, and the other, a quite common trouble, a complaint of descent when it is not present. The demonstration of the fact of descent is not difficult, but the complaint of descent of the womb is quite common in women who are not suffering from it. This is not malingering in most cases, but the statement is made on account of certain pains which she has, and which another woman tells her are those which accompany the descent of the womb.

Where the descent of the womb is established without cavil, the question arises as to whether or not the responsibility of the descent can be fixed on another person. Then the possibility of malingering must not be overlooked.

If the woman has had children, the question cannot be settled unless reliable medical evidence can be obtained of a recent medical examination of the person complaining. The mere statement by a woman that she has got a displacement, whether backwards or downwards, and that since her last child was born she has not had any displacement, from weakening of the supports of the womb in labour, does not make it certain that there was no displacement before the accident. In fact,

the probabilities are very strong against the woman's statement being true, even if she believes in it.

Cases of backward displacement of the womb (retroversion) come before us very commonly both in married and in single women. These displacements are discovered because the woman has some symptoms which lead to a careful internal examination being made. The usual symptoms are pain, bearing-down sensations, or discharge from the front-passage, or all three combined. In not a small number of cases the patient dates, or thinks she dates, the symptoms from an accident, such as overreaching, falls on the back downstairs or upstairs, falls from a bicycle, from a horse or a trap, or a slip off a tram step. Sometimes the woman says she "felt something give way inside." If after this a backward displacement of the womb is found, nothing is more easy than to attribute it to the accident. If, however, we examine the case more carefully, we find the solution of the difficulty not nearly so simple. We may find that the womb shows signs of old displacement, and this could not have been caused by the accident at all.

(B) *Pregnant Womb: Abortion.*—The malingering of abortion is not uncommon, and may be hard to disprove if the woman is examined a long time after. (See above, Diagnosis.) The signs of recent abortion are fairly clear for the first fourteen days afterwards; but beyond that, if the abortion occur during the earlier months of pregnancy, it may be impossible to say whether or not the woman has aborted.

*Malingering of Pregnancy.*—The malingering of pregnancy is mixed with the condition where a woman who has incurred the risk thinks she is pregnant, and as the months pass by adopts the attitude and swelled abdomen which is the correct one for the time of pregnancy to which she thinks she has reached. Chloroform dispels this phantom pregnancy as the patient goes under.

(v.) **The Tubes.**—There is nothing about these except that they are frequently the site of inflammation, of which infection through the womb is the usual course, and perhaps gonorrhœa the commonest.

(vi.) **The Ovaries.**—Pain over the ovaries is exceedingly common. Most women have some pain for from one day to fourteen days every month, so that a mere complaint that pain is due to an accident should be received with the greatest caution.

(vii.) **The Peritoneum** (the Internal Covering of the Organs).—Some degree of peritonitis occurs round the womb of nearly every woman who has had any inflammation of the womb.

A slight tear of the mouth of the womb, common in confinements, may lead to some degree of local peritonitis. It leads at all events to some inflammation of the tissue round the womb (cellulitis), the symptoms of which, as felt by the woman, resemble peritonitis localized round the womb. This is very common, and should not be attributed to accident, though the woman may never have noticed it until the accident made her think deeply about her internal concerns.

(viii.) **The Urinary System.**—Malingering in connection with the urinary system has been known; for instance, a woman said she never passed water, and was unable to do so. Although this was not in relationship to an accident, it is quite possible for this to be alleged, if responsibility can be put on some person. There is no difficulty in establishing the fact that the patient must pass water somehow, for if not the bladder would distend to an enormous degree, and very serious symptoms would arise. A common hysterical claim is inability to pass water, and a demand that an instrument (catheter) should be used to draw off the urine. The cure for this lies with the nurse, who has to exercise a severity of demeanour and lack of encouragement for the repetition of the operation till the woman gets annoyed and ceases to require attention.

**Hysteria.**—The malingering attitude, and conditions, resembling it, of pure hysteria as are common among women who are infinitely ingenuous in deceiving when they think fit; but there is a clear distinction to be drawn between hysterical assertions, which although they are untrue are not malingering, and the malefactor who constructs a plausible tale to get compensation. Hysterical complaints are common enough, but hysteria is not malingering, although there is often some difficulty in separating the two. As an example, it is not uncommon for a woman to assert that she has some internal injury in the passages, the womb, or the ovaries, as the result of a fall or an assault.

A careful medical examination will reveal whether there is any tangible or visible wound, bruise, laceration, displacement, etc. If there is no evidence of injury found, the patient may be termed a malingerer in that one respect.

Nevertheless, she may have some pain of quite natural causation, which she attributes to an injury, and this cannot

be called malingering, unless the patient is able to go about, enjoy life, etc., when off her guard.

Again, an hysterical woman—*i.e.*, one who is known to be the subject of hysterical attacks—very commonly complains of pain in the region of the ovaries. This cannot be called malingering, even though no tangible disease or injury be found. There may be some inflammatory cause for the pain, which is not obvious except when the organ can actually be seen. (See Operation.)

### Criminal and Self-inflicted Wounds.

**Homicidal and other wounds** may injure any part of the female generative system, and do not differ in their results from the accidental injuries already discussed.

Under this heading, however, it may not be out of place to mention here the injuries and consequences of attempts in the induction of abortion (illegal operations).

The common methods of inducing abortion are—

1. The introduction of instruments into the womb to break up the contents or to separate the contents from their attachments to the uterus.
2. The injection of irritating substances, like glycerine, into the womb, to try and set up muscular contractions whereby the womb will expel its contents.
3. The administration of abortifacient drugs.

1. The effect of the instruments may be injury to the vagina or uterus, or perforation of either. (See above, Anatomy.) These injuries in themselves are rarely serious, but inasmuch as dirty instruments may be used, septic infection nearly always follows. The result of this may be severe illness from blood-poisoning (septicæmia), or inflammation of the lining of the abdomen (acute septic peritonitis), which is fatal in most instances. Injuries to the neck of the womb, it must not be forgotten, may be occasioned by efforts at emptying the uterus with the finger or instruments, and not always by the attempt to induce abortion. Blood-poisoning (acute septic infection) may occur without any visible injury to the womb, the poison germs gaining entrance into the system through the raw surface of the interior of the womb, from which the products of conception have been detached.

Such blood-poisoning (acute septic infection) may follow a natural abortion, and hence the mere occurrence of so serious

an illness does not necessarily in itself indicate a criminal operation. Septic infection may be immediately fatal in these cases, from general peritonitis. It will at least cause prolonged illness, as infection may travel from the womb up the Fallopian tube to the ovaries, and set up a milder and more local form of peritonitis. The remote effects of this will be bands and adhesions, which will probably necessitate a surgical operation, and may cause permanent ill-health and sterility from constriction of the tubes to the womb down which the human egg passes.

2. The injection of irritating substances, again, is not necessarily harmful, but septic infection may be introduced in this way just as by dirty instruments, with similar consequences.

3. The so-called abortifacient drugs, such as ergot, savin, diachylon, etc., are doubtful in their action, but nearly always produce a serious illness, and even death in the case of the more poisonous ones.

**Suicidal wounds** are very rarely inflicted on the generative organs, but it is not unusual for injuries to be self-inflicted to procure abortion, and more than one case has been known in which a girl opened her own abdomen to empty a pregnant uterus. As these self-inflicted wounds are usually made with sharp instruments, like scissors, knives, hat-pins, etc., the injuries inflicted are more likely to be severe than in those made by criminal abortionists. Even the bladder may be perforated, the back-passage (rectum) opened, the womb (uterus) cut and lacerated, or the lining of the abdomen (peritoneum) pierced. In this way very serious results may follow, such as acute septic infection, peritonitis, etc.

The question for a medical man to settle in such cases would be whether the wounds are self-inflicted or not. Often decision is impossible, for the injuries inflicted by ignorant persons (second parties) to produce abortion have been known to be very bizarre and severe. Probably, if any other part was injured beside the uterus, the presumption would be that the wounds were self-inflicted.

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*For legal cases of injuries to the Female Generative Organs, including accidents connected with Pregnancy, see CASE GUIDE :  
Genital Organs—Female.*

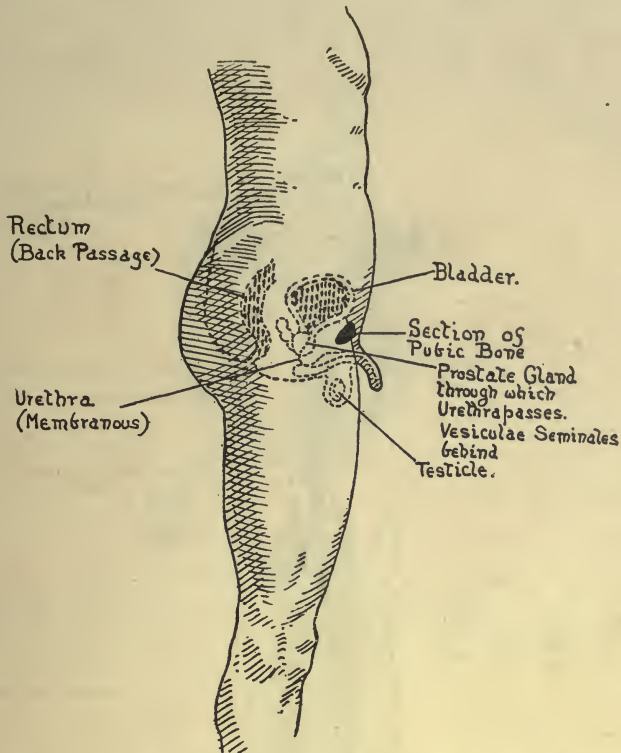


FIG. 88.—PROJECTION OF THE PELVIC ORGANS OF THE MALE.  
The cord from the testicle, lying to one side, is not shown.

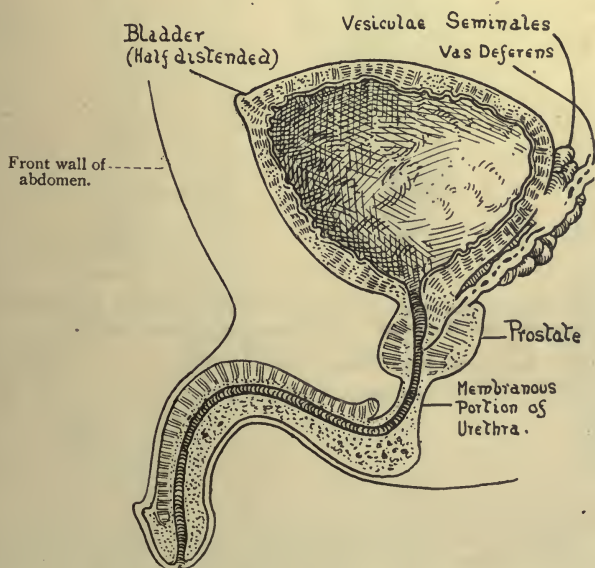


FIG. 89.—SECTION OF THE MALE BLADDER, WATER-PIPE, PROSTATE GLAND,  
SEMINAL RESERVOIRS (VESICULÆ SEMINALES), AND TESTICLE DUCT (VAS  
DEFERENS).

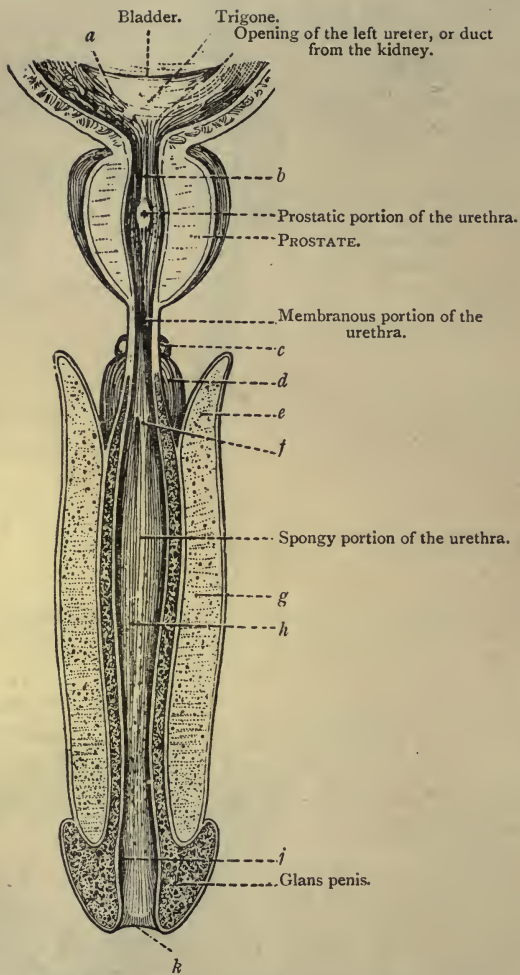


FIG. 90.—THE MALE URETHRA (OR WATER-PIPE) FROM THE BLADDER AND BASE OF THE BLADDER, LAID OPEN FROM THE FRONT.

*a* to *k* are parts having special names.

(From Buchanan's "Anatomy.")



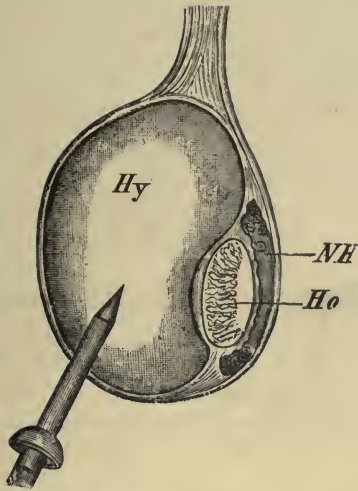


FIG. 91.—METHOD OF TAPPING a HYDROCELE.

*Hy*, The space between the two layers of the covering (tunica vaginalis) of the testicle distended with fluid and pierced by a "trocar and cannula" to let out the fluid; *Ho*, the testicle in section; *NH*, the epididymis.

(From Rose and Carless's "Surgery")

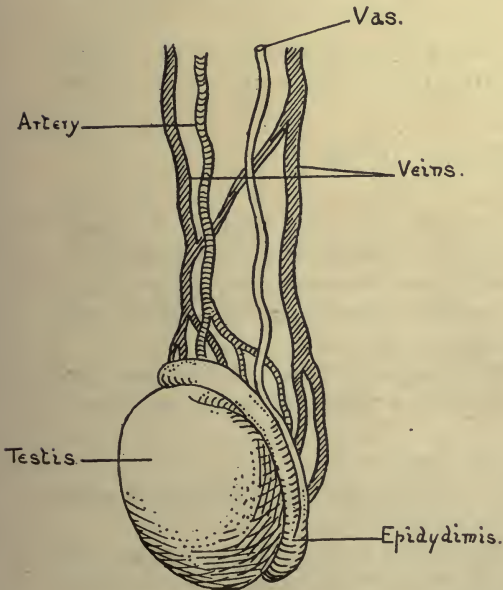


FIG. 92.—THE TESTICLE REMOVED FROM ITS COVERINGS (TUNICA VAGINALIS AND SCROTUM), WITH THE COMMENCEMENT OF THE SPERMATIC CORD. THE MUSCLE OF THE TESTICLE (CREMASTER) IS ALSO REMOVED, BUT THE TESTICLE DUCT (VAS DEFERENS), THE ARTERY, AND VEINS, REMAIN, THOUGH SEPARATED ARTIFICIALLY.

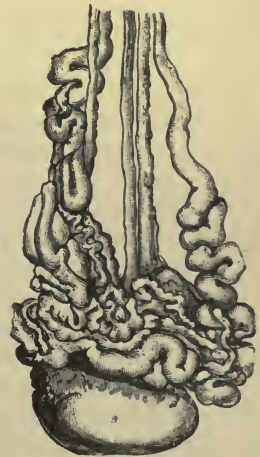


FIG. 93.—VARICOCELE.

The testicle is removed from its coverings, showing the distended and convoluted veins.

## GENITAL ORGANS—MALE.

By JOHN PARDOE,

M. B., F. R. C. S.,

Assistant-Surgeon to St. Peter's Hospital for Stone and Genito-Urinary Diseases, and Assistant-Surgeon to the West London Hospital.

### Head-note.

THE most important consequences of injury to the genital tract are—

1. Sterility, caused either by atrophy or wasting away of the testicles, or by the blocking of their ducts (vasa deferentia).
2. Obstruction, immediate or subsequent, to the outflow of urine, caused by injury to the water-pipe (urethra).

### Technical Terms.

*Castration.*—The removal of a testicle.

*Chancre.*—An infectious ulcer on the genital organs. If “hard” it is caused by syphilis, if “soft” by the bacteria of soft chancre.

*Cord, Spermatic.*—The cord which suspends the testicle in the scrotum; it is composed of cremaster muscle, nerves, arteries, veins, and the vas deferens. [Figs. 92, 163.]

*Cremaster.*—The muscle which suspends the testicle in the scrotum. It elevates the testicle into the fold of the groin under the influence of cold and other stimuli.

*Dermatitis.*—Inflammation of the skin.

*Épididymis.*—The collection of tubes from the testicle, lying at the back of that organ. [Figs. 91, 92.]

*Extravasation of Urine.*—The escape of urine into the tissues due to the giving way of the bladder or of any of the urinary canals from the kidneys to the tip of the penis.

*Gonorrhœa.*—An inflammation common in the urethra, caused by a definite microbe—the gonococcus.

*Hæmatocèle.*—A collection of blood in the sheath of the testicle—*i.e.*, the cavity of the tunica vaginalis.

*Hjdrōcēle*.—A collection of clear fluid in the sheath of the testicle. (See Hæmatocele.) [Fig. 91.]

*Micturitiōn*.—The act of voiding urine.

*Pēnis*.—The male organ of sexual connection. [Figs. 88, 89, 90.]

*Pērīnēum*.—The "crutch." The space between the thighs of both sexes. It extends in the male from the back-passage (the anus) to behind the purse (scrotum) in front. [Fig. 88.]

*Prēpūce*.—The foreskin.

*Prōstāte Gland*.—A solid organ, consisting of two parts or lobes, lying at the neck of the bladder, around the commencement of the urethra. In later life great difficulty is often caused by enlargement of this gland, which, by pressing upon the urethra, closes it and prevents the easy passage of urine through it. [Figs. 12, 13, 14, 15, 88, 89.]

*Scrōtum*.—The pouch in which the testicles are suspended.

*Sēmēn*.—The procreating liquid derived from the testicles and prostate gland, and containing the spermatozoa.

*Sēmīnal Vesicles*.—The reservoirs for semen placed at the base and behind the bladder. [Fig. 89.]

*Spermātōzōā*.—The minute elements in the semen which unite with the ovum, or egg, of the female, fertilizing the latter and causing conception. Each spermatozoon consists of two parts—a head and a tail. The tail possesses motile power, and by its movements propels the spermatozoon. The head is the fertilizing part of the spermatozoon. The tail drops off when the spermatozoon unites with an ovum.

*Stricture*.—A contraction or narrowing of any canal, such as the water-pipe (urethra).

*Syphilis*.—A highly contagious disease characterized by three stages, any one of which may, however, be absent.

*Testicles*.—The two spermatozoon-producing glands contained in the scrotum. [Figs. 88, 91, 92, 93.]

*Tūnicā Vāgīnālīs*.—The thick lining of the purse, or scrotum, which also covers the testicles. In health there is a space between the two layers, which are almost in contact, like the eye and eyelid. A very little fluid is secreted by this lining, and keeps the surface of the testicle constantly moist, so that it slides about easily in the purse. (See Hydrocele and Hæmatocele.) [Fig. 91.]

*Ūrēthrā*.—The common urogenital canal from the bladder to the end of the penis. It carries urine from the bladder and semen from the testicles. The site of gonorrhœa and stricture. [Figs. 88, 89, 90.]

*Ūrēters*.—The tubes which convey the urine from the kidneys to the bladder. [Figs. 90, 128, 129, 130.]

*Vāsā Dēfēvēntīa*.—The two tubes carrying semen from the testicles to the urethra. [Figs. 89, 92, 162, 163.]

*Vēsīculæ Sēmīnālēs*.—See Seminal Vesicles. [Fig. 89.]

### Anatomy.

The genital tract consists of two portions :

1. Purely genital: the testicles, their ducts (vasa deferentia), and reservoirs for semen (seminal vesicles).
2. Genito-urinary: the prostate gland and penis, containing the water-pipe (urethra), common to both genital and urinary tracts.

The testicles are two solid glands composed of numerous minute tubules in which the spermatozoa are developed. These tubes pass to the back of the testicle, and are there collected into a cap called the "epididymis," from which runs a thin hollow cord, the duct of the testicle, and called the "vas deferens." [Figs. 88, 89, 92, 93.] It is about as thick as a whip-cord, and resembles it to the surgeon's touch. This cord runs at the back of the purse, or scrotum, and, passing through an opening in the muscles at the fold of the groin, called the "external inguinal ring," runs between the muscles of the abdominal wall in a canal called the "inguinal canal." It pierces the deeper layers of the abdominal muscles by passing through another opening called the "internal inguinal ring," and so enters the cavity of the abdomen. [Figs. 161, 162.] Running along the sides of the bladder, the two testicle ducts (vasa deferentia) converge towards its base, and, piercing the substance of the prostate gland (see below), they enter the urethra just in front of the bladder. [Fig. 89.] The canal through which they pass, from the external to the internal inguinal rings, is known as the "inguinal canal"; and it is through this canal that the majority of the ruptures pass downwards. (See Rupture, p. 691.) [Figs. 162, 163.]

Just before entering the prostate gland, the two ducts of the testicles are joined by two small canals from two receptacles or reservoirs of semen (seminal vesicles) which lie at the back of the bladder. They are really long coiled tubes which hold the semen, and discharge it, according to most authorities, when ejaculation takes place during sexual intercourse. During the period of rest from sexual activity the testicles continually secrete semen, which passes up along the testicle ducts (vasa deferentia) into the seminal vesicles. Here the semen remains until ejaculated in sexual intercourse. Other authorities hold that the seminal vesicles are not reservoirs for semen, but that

they only discharge mucus to render the semen more liquid and copious. [Fig. 89.]

The prostate gland is a solid body lying just outside the entrance of the bladder, and is indented in the middle by the urethra, which is embedded in it. It has numerous little ducts or tubules, which open into the urethra. It secretes a thin fluid, which is added to the semen from the testicles. This gland frequently enlarges in old age, and causes an obstruction to the passage of water by pressing on the urethra. (See below, Diagnosis.) [Figs. 12, 13, 88, 89.]

The testicles hang suspended in the purse, or scrotum. This purse is composed of an outer layer of skin and muscle and an inner layer or lining known as the "tunica vaginalis." This layer lines the scrotum and covers the testicles, leaving a space between the two layers. In health the two layers are almost in contact, like the eye and eyelid. A very little fluid secreted by this tunica vaginalis keeps the surface of the testicle constantly moist, so that it slides about easily in the purse. Sometimes this fluid increases very much, commonly as the result of disease, but occasionally as the result of accident. The collection of fluid is known as "hydrocele." [Fig. 91.] If blood is poured out into the space between the two layers, the swelling is called a "hæmatocele."

The cord which suspends the testicle in the purse is known as the "spermatic cord." [Figs. 92, 162, 163.] It consists of the duct of the testicle (vas deferens—see above), the veins, arteries, and nerves of the testicle, with a muscle called the "cremaster muscle." This muscle has the property of drawing up the testicle when it is stimulated by cold, blows, or by sexual excitement.

The pipe from the bladder through which the urine passes is used also for the passage of semen; for the testicle ducts (vasa deferentia) open into it, as has already been described. It is known as the "urethra," and runs from the bladder to the tip of the penis. It passes through the prostate gland, then along the crutch, and finally through the pendulous parts of the penis on the under surface of the latter. [Figs. 88, 89, 90.]

The penis consists of several portions. At the end is the soft portion known as the "glans penis." This is very sensitive, the skin covering it being richly supplied with the nerves of sensation. It is covered by the foreskin. The body of the penis is made up of two firm portions, one on either side, which consist of large spaces filled with blood. During sexual excite-

ment a great excess of blood rushes into these spaces and causes erection. Below and between these two portions lies a softer portion, which contains the urethra. These parts of the penis are bound together by a fibrous sheath, and are covered with skin. [Figs. 88, 89, 90.]

The bladder, or reservoir for the urine, when empty, does not rise above the bones of the pelvis or hips. [Figs. 89, 90, 163.] When very full it may rise into the abdominal cavity, and is then beyond the protection of the bony walls of the pelvis in front, and may be seriously injured by blows on, or crushes of, the soft wall of the abdomen. The bladder is composed of thick muscle, by which the urine is expelled, and is lined by a thin lining of mucous membrane. Into it the urine trickles from the kidneys above, and from it the urine is expelled along the urethra below. Two tubes carry the urine to it from the kidneys. These are known as the "ureters." [Figs. 90, 128, 129, 130.]

### Consequences of Accident.

Strictly speaking, these should be divided into two sections—the first is purely genital, and the second the common urogenital canal—but it is more convenient to deal with them together. The following are the parts liable to injury, and dealt with separately:

- (i.) The purse, or scrotum.
- (ii.) The sheath of the testicles (the tunica vaginalis).
- (iii.) The testicles.
- (iv.) The ducts from the testicles (the vasa deferentia).
- (v.) The reservoirs for semen (the vesiculæ seminales).
- (vi.) The penis.
- (vii.) The water-pipe in the penis (the urethra).

(i.) **The Purse, or Scrotum.**—Lacerated and contused wounds of the scrotum are fairly common, and they heal readily without serious after-effects.

The scrotum being very lax, blood is easily effused into its walls as the result of injury, and this may lead to a blood-tumour, or hæmatoma. No serious after-effects are to be expected, though occasionally an abscess may result.

Chronic irritation, producing, for example, inflammation of the skin, or even cancer, are discussed under the head of that cases, below.

Direct blows or crushes of the scrotum and testicle sometimes cause the formation of a hæmatocele, the blood being effused directly between the two layers of the tunica vaginalis.

(ii.) **The Sheath of the Testicles (the Tunica Vaginalis)** [Fig. 91].—This sheath is in two layers; the one layer closely covers the testicle itself, and the other lines the scrotum. In health the actual space between is no more than between the eye and eyelid, as has been already said above. This fluid between the two layers of the tunica vaginalis very frequently becomes increased as a result of disease. When the fluid is clear it is called a “hydrocele”; when bloody, a “hæmatocele.” A hæmatocele is sometimes caused by accidental puncture of a small vein in tapping a hydrocele. It has frequently been claimed that accident has caused a hydrocele; such a claim must be very fully proven before it should be accepted. As a result of accidental bruising, etc., of the scrotum and testicle a hydrocele is somewhat rare. A hæmatocele might arise in consequence of an injury to an old hydrocele, but the usual explanation of this is given above—namely, a tapping of a hydrocele.

(iii.) **The Testicles** [Figs. 88, 92, 93].—Bruises or blows upon the testicle cause inflammation of the testicle or of the epididymis. (See below, Diagnosis.)

This inflammation may subside, or proceed to form an abscess. The result may be so severe as to destroy the semen-producing properties of the testicles, or to cause blocking of the small ducts, preventing the passage of semen into the vasa deferentia. Complete disorganization of both testicles produces a condition of eunuchism, the usual virile characteristics not appearing as puberty is passed. Double castration in adult life has a partial effect of this nature. The most serious consequence of double castration is the complete sterility of the individual. (The question of sterility or fertility can only be decided by an examination of the semen to ascertain the presence or absence of live spermatozoa.)

(iv.) **The Ducts from the Testicles (the Vasa Deferentia)** [Figs. 89, 92, 162, 163].—The vasa deferentia may be crushed, wounded, or divided. If divided completely on both sides, sterility ensues. The same may occur from inflammation following upon an injury.

(v.) **The Reservoirs for Semen (the Vesiculæ Seminales)** [Fig. 89].—These could not be injured alone, but in very extensive injuries to the organs in the pelvis they might be

involved. This contingency is not worthy of a separate consideration here.

(vi.) **The Penis** [Figs. 88, 89, 90].—The whole penis may be torn off by severe crushes and machinery accidents. Usually in such cases the other injuries are so severe as to prove fatal. If the patient survive, the consequent effects will be, first, impotence, owing to the male organ being removed; and, secondly, stricture of the torn water-pipe (urethra) is liable to follow.

Contusions, wounds, lacerations, etc., of the penis may be followed by effusion of blood into the body of the organ, causing a hæmatoma, abscess, or gangrene, and, later, deformity of varying degree. If the water-pipe is in any way injured, stricture is extremely liable to follow. (See below.)

(vii.) **The Water-Pipe (Urethra)** [Figs. 88, 89, 90].—(a) The insertion of foreign bodies into the male urethra may be done by the patient himself or by companions—in the latter case usually in a drunken freak. The foreign bodies seen by the writer include the stem of a pipe, a long wax taper used for lighting candles, a stalk and head of wheat, a black-headed hatpin, hairpins, a meat skewer, and various objects. Their removal is not usually attended by much difficulty, and the after-consequences are slight, unless violence has attended their introduction and has damaged the canal. As has been said before, injury to the urethra is almost always followed by inflammation and subsequent stricture.

(b) Wounds of the perineum, contusions and crushes, and the more extensive injuries involving the pelvis, if they open the water-pipe (the urethra), will be followed immediately by escape (extravasation) of urine into the parts round. If the urethra is severely injured but not opened, extravasation of urine may follow later, in the course of a few days, owing to the giving way of the urethral wall. This is a most serious accident, and, unless treated promptly by operation, the escape of urine into the tissues of the body will spread high up upon the abdominal wall, and terminate in death from blood-poisoning. The after-result is certain to be stricture of the urethra of greater or less severity, which may be curable or may require attention to the end of the patient's life. (See below.)

(c) *Contusions and Bruises of the Perineum.*—The most common causes of these injuries are machinery crushes, street accidents, kicks upon the space in front of the back-passages (perineum) from horses and from men, breaking down of a bicycle, falling astride beams, scaffolding poles, and similar objects.



## Disease.

**I. Produced by the Accident.**—(i.) **The Scrotum.**—A varying degree of deformity will be produced by severe inflammation consequent upon injuries. This, while not causing any serious result to the patient's health, may be a source of annoyance to him.

*Skin Inflammation and Cancer.*—The skin of the scrotum is sometimes intensely irritated by such agents as petroleum, causing an inflammation, or dermatitis, which, if prolonged and untreated, is liable to terminate in cancer of the skin. The inflammation is due to the patient's clothes being constantly saturated with the irritating substance. Removal of the cause removes the inflammation; but if this has gone farther, and become cancerous, a serious operation is required—viz., the removal of the diseased parts. In former days the scrotum of chimney-sweeps was often affected by cancer following upon inflammation. This was caused by the rubbing in of soot during the climbing of chimneys, in which fashion the sweeping was performed. It was well known as "chimney-sweep's cancer," and is now a scheduled disease within the Workmen's Compensation Act, 1906. (See Skin.)

(ii.) **The Sheath of the Testicle (the Tunica Vaginalis)** [Fig. 91].—Fluid poured out into this sheath has been described above as an unlikely consequence of accident, but as a common disease without accident.

(iii.) **The Testicles** [Fig. 92].—Atrophy of the testicle is a consequence of severe injury to the testicles even where no destructive abscess has occurred, and then sterility is the only important result.

(iv.) **The Ducts from the Testicles (the Vasa Deferentia)** [Figs. 89, 92, 162, 163].—Disease of these ducts is exceedingly common. Inflammations affecting the urethra, prostate, and seminal vesicles, tends to spread along these ducts towards the testicles, and the same may be said of inflammation of the testicle, which spreads in the other direction. If inflammation of the ducts is very long continued, closure of them may occur, with the result that the patient becomes sterile.

Injuries of the urethra, prostate, and testicles may be the starting-point of disease in the vasa deferentia, but the most common cause of inflammation of these ducts is undoubtedly gonorrhœa. It may be said that inflammation is caused frequently by disease; rarely, if ever, by accident.

(v.) **The Reservoirs of Semen (the Vesiculæ Seminales)** [Fig. 89].—These reservoirs are so deeply placed that disease immediately caused by accident is practically impossible; but an inflammation of the bladder, prostate, urethra, vasa deferentia, and testicles may eventually spread to the seminal vesicles.

(vi.) **The Penis** [Figs. 88, 89, 90].—As has been already stated, injury to the penis may lead to such deformity that sexual intercourse is impossible, but the serious injuries affect the urethra also, for which see below.

(vii.) **The Water-Pipe (Urethra)** [Figs. 88, 89, 90].—Injury to the urethra may be followed by stricture. This stricture is known as “traumatic stricture,” and although not nearly so common as stricture due to disease (usually gonorrhœa), it is met with fairly frequently. It must not be forgotten that traumatic stricture may follow an injury of the penis or crutch, and may leave no external scars or signs. In such a case the diagnosis is extremely difficult, and much will depend upon the evidence of the doctor who saw the patient soon after the alleged injury. We may instance the following case illustrating this point: A railway-guard walked off the end of a temporary station platform in the dark, being unacquainted with his surroundings, and fell astride the buffer of a truck which was backed up to the end of the temporary platform. There was no external wound, but there was much bruising of the scrotum and crutch. A blood-tumour formed in the scrotum, and he passed blood in the urine, showing that the urethra was damaged. Six weeks later all signs of external injury had disappeared, but a tight stricture had formed, which was only cured after some months of treatment.

2. **Existing before the Accident and aggravating its Effects.**—The diseases most seriously affecting the results of injury to the genital system are—

- Tuberculosis.
- Syphilis.
- Gonorrhœa.
- Diabetes mellitus.
- Nervous disorders.
- Stone.
- Enlarged prostate.

**Tuberculosis.**—Tuberculosis of the testicle which has been

apparently healed or has been quite quiescent for years may start into activity again as the result of injury.

**Syphilis.**—A patient who has suffered from syphilis, but has been apparently well for years, may, as the result of injury to the testicle, have an undoubted syphilitic outbreak of that organ immediately subsequent to the injury, although the testis had shown no sign of syphilis previously.

**Gonorrhœa.**—Injury, such as a very slight blow, to the testicle of a patient suffering from acute gonorrhœa, even of a very mild degree, may be followed by an acute inflammation of the epididymis and testis. This is, however, very common from gonorrhœa without injury. Injury to the urethra of a patient suffering from gonorrhœa will much aggravate the condition, and may lead to abscess round the water-pipe (periurethral abscess), extravasation of urine, or subsequent stricture.

**Diabetes Mellitus.**—Injury to the urethra of a man suffering from diabetes is liable to be followed by a very dangerous inflammation, leading sometimes to mortification (sloughing) of the canal, with extravasation of urine, and sometimes to death.

**Nervous Disorders.**—Injury to any part of the genital system, whether followed by any permanent physical results or not, is in some individuals followed by mental disturbance out of all proportion to the severity of the condition. In some cases a condition of sexual hypochondriasis is produced, resulting in “psychical impotence,” although physically the patient is perfectly capable of performing the sexual act.

The bladder, kidneys, and other ducts (ureters), may become involved in infection spreading upwards from the urethra or from the testicles. This does not usually occur, but in some cases it may be impossible to prevent it.

**Stone in Bladder.**—A stone may be present in the bladder at the time of injury, and may modify the case. Symptoms which might be referred to the results of injury may in reality be due to the stone in the bladder. A careful consideration of the previous history of the case and of symptoms antecedent to the injury is of the utmost importance. [See Fig. 16.]

**Enlarged Prostate.**—Enlargement of the prostate gland is an exceedingly common occurrence in men above the age of sixty. In a considerable number of cases it gives rise to difficulty in passing urine, and it is very necessary to distinguish between the difficulty due to enlargement of the

prostate and that due to stricture of the urethra the result of accident. The shock of an accident to the genital system may precipitate an attack of retention of urine caused by enlargement of the prostate. But the difficulty of diagnosis will arise when interference with micturition comes on some time after an accident, and here the services of a skilled surgeon will prove to be essential. [Figs. 12, 13, 14, 15, 88, 89.]

### Operation.

(i.) **The Purse, or Scrotum.**—Cancer of the scrotum calls for early removal, and the resulting wound may be so extensive as to require a skin-graft to enable it to heal with rapidity.

(ii.) **The Sheath of the Testicles (the Tunica Vaginalis)** [Fig. 91].—Fluid collected in this sheath, whether the fluid be clear or bloody, is easily let out by the simplest of processes—that of “tapping” with a hollow needle. This is a trivial operation, and commonly done by the student at the hospital under the supervision of the surgeon. If, as is common, the fluid returns, then a more extensive operation may be done. This consists in either injecting into the space some irritant antiseptic fluid, as carbolic acid or iodine, or in opening the walls sufficiently widely to allow the fluid to at once escape, as soon as it forms. The two layers of the sac eventually unite, and cure results. This “open operation,” as it is called, is commonly performed in case of blood being in the space, when a hæmatocele is present.

(iii.) **The Testicles** [Figs. 92, 93].—Castration, or removal of a testicle, is very rarely required as a result of accident. The operation is chiefly serious from the sterility it produces. Double castration is sometimes followed by the most serious symptoms, especially in old men. The writer has seen acute insanity follow this operation.

(iv. and v.) **The Ducts from the Testicles (the Vasa Deferentia)** [Figs. 89, 92]; **the Reservoirs for Semen (the Vesiculæ Seminales).**—These are very seldom operated upon separately.

(vi.) **The Penis** [Figs. 88, 89, 90].—This might have to be amputated as the result of accident, but such contingency is very unlikely.

(vii.) **The Water-Pipe (or Urethra)** [Figs. 88, 89, 90].—Injuries to the water-pipe which eventually lead, or threaten to lead, to obstruction to the free flow of urine, a stricture being formed in the canal, will demand an operation.

The operations are of three kinds :

1. The urethra is torn by the accident.

This requires stitching up immediately over a pipe introduced into the canal, over which the pipe can heal.

2. The urethra is constricted after healing.

Simple dilatation by graduated dilators (bougies) may be sufficient.

3. A definite constriction has grown which impedes seriously the outlet of urine.

The narrowing stricture must be divided.

**Extravasation of Urine.**—A most serious condition, which must be treated by free incisions to allow of the escape of urine from the tissues.

### Cure.

(i.) **The Scrotum.**—Wounds, lacerations, and inflammations of the scrotum usually heal rapidly, and will only delay active work for a few days to a week, according to the nature of the work. Cancer of the scrotum, when cured by operation, will take the time to heal the skin-wound. This depends on its size and skin-grafts, so that no time can be given.

(ii.) **The Sheath of the Testicles (the Tunica Vaginalis).**—Cure after tapping is a trifling matter where no claim is being made against another person; the man usually walks home and goes to work the next day. Perhaps three days would be a safe margin for rest after tapping and injecting.

After the larger operations a man must lie up for, say, three weeks.

(iii.) **The Testicles** [Figs. 88, 92, 93].—To save a damaged testicle may demand prolonged rest, even extending over two or three months. Cure after operation for removal is usually rapid.

(iv. and v.) **The Ducts from the Testicles (the Vasa Deferentia); the Reservoirs for Semen (the Vesiculæ Seminales).**—These are so seldom injured alone that no time for cure can be given.

(vi.) **The Penis** [Figs. 88, 89, 90].—Usually heals quickly; but if serious extravasation of urine has occurred, many weeks may be necessary for cure.

(vii.) **The Water-Pipe (or Urethra)** [Figs. 88, 89, 90].—A complete cure of a traumatic stricture may be looked for in some cases, but in others—*e.g.*, where a severe stricture persists for the rest of life—a true cure cannot be looked for, as the patient needs attention on and off for the remainder of his life;

and frequently he will require to have an instrument passed to widen the stricture, and he may have always to carry with him a pipe (catheter) to draw off urine when necessary.

It is impossible to state the length of time at the end of which work can be resumed. Each case must be judged upon its own merits. For example, a slight contusion of the urethra may be followed by a return to work in a week, or, if the patient is in poor health at the time, there may result an escape of urine into the tissues of the body (extravasation of urine), and then the patient may nearly lose his life, and be laid up for six to twelve months.

### Return to Work.

(i.) **The Scrotum.**—Injuries will, as a rule, only delay return to work for a few days to a week, according to the severity of the injury and nature of the work. Obviously, a horseman or bicyclist would be absent longer than a shop-assistant or clerk. After operation for cancer of the scrotum, as soon as the skin is healed, with, say, a fortnight interval, the man can return to work.

(ii.) **The Sheath of the Testicle (Tunica Vaginalis)** [Fig. 91].—As soon as the man is surgically cured he can return to work, unless the parts are specially exposed to friction, as in a rider, etc.

(iii.) **The Testicles** [Figs. 92, 93].—Complete removal of the testicle should permit the man to return to work three weeks after the operation. Injuries not requiring removal will be slow, and convalescence will be protracted.

(iv. and v.) **The Ducts from the Testicles (the Vasa Deferentia); the Reservoirs for Semen (the Vesiculæ Seminales).**—See Cure.

(vi.) **The Penis** [Figs. 88, 89, 90].—The penis usually heals rapidly, but it is impossible to lay down any rules as to return to work.

(vii.) **The Water-Pipe (or Urethra)** [Figs. 88, 89, 90].—Simple contusions heal up rapidly; ruptures and wounds may take many weeks, and the strictures sometimes resulting may cause absence from work for months.

### Recurrence.

It is almost impossible to lay down any rules as to recurrence of conditions caused by accident. Thus, a man may have a slight stricture of the urethra caused by injury, and be apparently

cured. A year later he may present himself with a more strictured condition of the urethra, which may be merely a continued contraction of the site of the old trouble, or may be due to disease acquired in the interval. Hydrocele of the tunica vaginalis tends to recur if only tapped, but if cured by a larger operation it does not recur.

In this connection, as in the case of the period required before return to work is possible, each case must be judged separately.

### Occupation Diseases.

There are no special diseases restricted to the genital system which can be attributed to special occupations, except inflammation of the skin of the scrotum, and even cancer, which occurs among chimney-sweeps and paraffin-workers. (See above, Disease.)

### Diagnosis.

The diagnosis of the conditions mentioned is not usually a matter of much difficulty. But there may be extreme difficulty in deciding some time after the alleged accident whether the condition undoubtedly present was due to that accident or was pre-existing.

As an example may be mentioned the case of stricture of the urethra, which is one of the commonest male illnesses, and almost invariably arises from old disease (gonorrhœa).

Where the scars of the wounds of the penis and perineum are present, it is a reasonable inference that the accident was the cause of the stricture; but it is well accepted that a contusion of the perineum, such as may be caused by falling astride a hard object, may leave no external mark, and yet may be followed by most difficult and intractable stricture. Here the evidence of the doctor who saw the case at the time of the injury is of the utmost value, for if, as is usually the case in such injuries, an instrument is passed to ascertain the condition of the urethra shortly after the accident, and the instrument passes easily, whilst later difficulty in passing urine and difficulty in the introduction of instruments follows, the stricture is clearly due to later changes following the accident. (See the case of the railway-guard above, p. 398.) In the case of disease following, or apparently following, injury to the testicle, unless there is definite evidence from examination shortly before the accident that the testicles were then diseased, it would be difficult to

state positively that the disease was or was not started by the accident.

In men above the age of sixty a very careful diagnosis must be made between the difficulty of passing water due to stricture, whether from disease or from accident, and that due to obstruction by an enlarged prostate gland, which is pure disease of old age unconnected with accident. It must not be forgotten that stricture and disease of the prostate may occur in the same patient.

Very often a prostate enlarges considerably, and yet gives little or no trouble for a very long time.

An accident near the prostate, but producing no effect upon it, may then direct the attention of the man to slight pains which he formerly did not notice.

Some of the most difficult cases to deal with are those of sexual hypochondriasis and impotence following accidents to the genital system. In these cases there may be no evidence of permanent injury or disease, but it is unquestionable that even slight accidents may be followed by great mental perturbation excessively difficult to cure.

### Malingering.

Pain is frequently complained of long after an accident to the genital organs. In some cases a testicle may remain tender and hypersensitive after it has apparently completely recovered, and be complained of by malingerers as an excuse for shirking work. If there are no signs of disease it is safe to say that the patient is quite able to work. Complaints of impotence, on the other hand, are impossible to verify or refute, though really not commonly justifiable.

### Criminal and Self-inflicted Wounds.

#### (a) Homicidal and Other Wounds intentionally inflicted.—

There is a considerable number of recorded cases of mutilation of the genitalia inflicted in revenge or from motives of jealousy. Certain of the worst class of men and women attack an opponent's genitalia in fights and brawls, and the police are well aware of the necessity of safeguarding themselves from this form of attack when dealing with the worst classes of criminals. The police, as is almost daily reported in the Press, constantly give evidence of being kicked "in the groin" when arresting a



rough. This is their euphemistic way of describing a deliberate kick in the genitalia.

In this connection may be mentioned two interesting instances of mutilation and the consequences.

The Editor was informed by an American doctor practising in Pekin that the eunuchs of the imperial palace are made so by a complete removal of the entire external genitalia, the penis and scrotum being cut off close to the abdomen. He has been called upon frequently to treat the very difficult and serious strictures, following the operation, of the remaining part of the urethra, and, indeed, the majority of the eunuchs suffer from stricture more or less severe.

After the Abyssinian campaigns the women followers of the army are stated to assist at the removal of the genitalia of prisoners, whether wounded or unwounded. The women drag forward the genitalia of the prisoner, and they are then removed by a sharp sweep of a curved knife close along the abdomen. The reason given for this horrible mutilation is that their enemy, should he survive and escape, will be unable to procreate other enemies of their country.

(b) **Suicidal and Other Self-inflicted Wounds.**—These are not uncommon in the case of certain mental diseases. In melancholia and certain forms of religious mania, mutilation of the genitals is not uncommon. The well-known instance of Origen is a case in point.

Children are given to mutilating themselves in these parts, especially by tying a string round the penis. (See Children, p. 233.)

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*For legal cases of injury to the Male Genital Organs, see CASE GUIDE: Genital Organs—Male.*



FIG. 94.—BACILLUS OF GLANDERS: *BACILLUS MALLEI*.

# GLANDERS.\*

By EDRED M. CORNER,

M.C., F.R.C.S.,

Surgeon to the Children's Hospital, Great Ormond Street; Surgeon to the Surgical Infectious Wards and to Out-Patients, St. Thomas's Hospital;

AND

FREDERICK HOBDAY,

F.R.C.V.S., F.R.S.E.,

Late Professor in the Royal Veterinary College, and late Examiner to the Royal College of Veterinary Surgeons.

## Head-note.

GLANDERS is a disease caused by the *Bacillus mallei*, which is found in the horse and other animals, and communicable to men by inhalation, or by inoculation into wounds or abrasions.

## Technical Terms.

*Bacillus mallei*.—The specific organism of glanders. [Fig. 94.]

*Culture*.—An artificial growth of organisms which may be made on gelatine, boiled potatoes, or in broth, etc. A culture may contain living organisms, or the organisms may have been killed by heat. In the latter case it is called a "sterilized culture." It still contains much of the poison (toxine) produced by the bacilli.

*Cönjunctiva*.—The lining of the eyelids and the covering of the white of the eye.

*Fārcý*.—The name given to glanders when it affects the skin.

*Mällēn*.—A sterilized and standardized culture of the *Bacillus mallei*. (See Diagnosis.)

*Mucous Membrane of the Nose*.—The lining skin of the nasal cavity.

*Normal Saline*.—A solution of common salt and water of strength equivalent to the percentage of salt in the blood.

\* A disease included in the third schedule of the Workmen's Compensation Act, 1906.

*Pyæmiã*.—General infection of the body with organisms, together with the formation of abscesses in different parts of the body. (See Inflammation—Pyæmia.)

*Pěvītōnēal Cavity*.—The abdominal cavity. [Figs. 151, 152, 153.]

*Spōrēs*.—When a micro-organism is exposed to circumstances adverse to its life, it produces a seed or spore which is thick-skinned, and so better adapted to withstand adverse conditions and to prolong existence of the species.

*Vīscěřã*.—The internal organs of the chest and belly.

### Nature of Glanders.

Glanders is a disease of equine animals, occasionally caught by man. It shows itself in the nose, eyes, and skin, and is, if acute, usually fatal, as it then affects the whole body; but if chronic it may be cured. Chronic glanders is rather the exception than the rule.

The disease is comparatively rarely seen in men, but is liable to occur amongst stable-attendants, farriers, and those whose duties bring them into close contact with the horse. It may assume either an acute or a chronic form, starting in the eye (conjunctiva) or nose (nasal mucous membrane), but, more often on the skin of the face and hands, inoculation having taken place through some insignificant abrasion or cut.

Glanders has been proved beyond all doubt to be due to a parasite called the "bacillus of glanders," or the *Bacillus mallei*. The parasite is a small, slender bacillus which is somewhat similar to the tubercle bacillus. When grown on sterilized boiled potatoes in the bacteriologist's laboratory, the bacilli form a yellow or brownish film which is quite characteristic. The bacilli do not form spores, but they will resist drying for many weeks, and appear capable of existing outside the body without losing their virulence. Their longevity, however, varies considerably, some cultures dying under favourable conditions, while others survive such unfavourable conditions as prolonged drying. This is very important when considering the possible source of infection.

The bacilli are present in all tissues affected with glanders, whether in man or beast. The incubation period, or the time between the infection and the first appearance of symptoms of the disease, is variable, usually between three and five days in the acute form.

The affection is readily caught by the discharges from the affected surfaces.

### Consequences of Infection.

Acute glanders runs a course either like severe typhoid fever or a septic infection, or it may even resemble an acute attack of rheumatism. At the point of inoculation, matter formation (suppuration) quickly takes place, abscesses form, and the surrounding tissues become inflamed. The suppuration spreads into the surrounding muscles, and into the tissues and skin. Ulcers and blebs may form on the surfaces, and not infrequently the inflammation spreads like erysipelas. The infection may extend farther, and finally infect the general system of the body, producing a condition of pyæmia with abscesses in any part. (See Infection—Pyæmia, p. 448.)

Finally many abscesses form (pyæmia); the patient shows symptoms of prostration, and death occurs with all the typical signs of septic poisoning (toxic intoxication).

Chronic glanders in man consists of the formation of "farcy buds." These symptoms of the disease bear a marked resemblance to corresponding conditions in tuberculosis and syphilis. In consequence tuberculous or syphilitic tumours have been asserted to be glanders.

A small circular nodule first appears, which varies in size from the head of a pin to a small pea; this will either early break down, forming an ulcer with a sharply defined margin and a very foul-smelling discharge, or else will continue to grow in size, forming the typical lump, or "farcy bud."

Chronic glanders presents a further similarity to tuberculous disease in the occasional formation of calcareous and cheese-like (caseous) deposits in the lungs, liver, testicles, and bones.

The changes produced by glanders in the skin lining (mucous membrane) of the nose consist of either a swelling with a discharge or of a growth of definite nodules resembling those produced by tubercle bacilli. These processes may also take place in the internal organs of man, producing either general swelling and inflammation or nodules, followed by necrosis (death) of the tissues, abscess, or cheese-like (caseous) formation.

It is not always easy to distinguish in man between the acute and the chronic forms, the one so often supervening on the other.

In chronic glanders the symptoms are all much milder; the formation of the farcy buds in the skin, together with the

enlargement of the glands and lymphatics, with little or no fever, and the slow course of the disease, are the chief features. (For Glanders in Animals, and the Mallein Test, see below.)

### Disease.

1. **Caused by Glanders.**—See Consequences of Infection, above. Subacute pneumonia is a frequent complication.

2. **Existing before the Accident and aggravating its Effects.**—Any weakness of the body produced by syphilis, tuberculosis, chronic alcoholism, starvation, or other unhealthy conditions, will aggravate the effects of this disease.

### Operation and Treatment.

Unless the case is seen early, there is little to be done. If general infection has taken place, recovery is impossible. Where the case is seen early, whether it is of the acute or of the chronic form, thorough extirpation by a surgeon of the local foci of infection should be undertaken.

Farcy buds should be opened, scraped, and cauterized, or, where possible, completely removed by operation. Little is known of its use in cases of glanders in man. The value of the treatment of the disease with vaccines cannot as yet be estimated, on account of the very recent use of the method.

### Cure.

The duration of this disease depends very much upon the powers of resistance of the individual attacked. In the acute form patients rarely survive longer than two or three weeks, the majority of cases ending fatally about the tenth day.

In the chronic form of glanders recovery takes place in about 50 per cent. of the cases, death, when it occurs, being due to the acute form of the disease becoming consequent on the chronic. The duration of chronic glanders is too variable, and the subsequent convalescence too uncertain in length, to be more than guessed at.

### Return to Work.

Those who have recovered from glanders should be able to return to full work when they are completely cured.

### Recurrence.

It is not known how much immunity from a further attack of glanders is given by one attack. By immunity we mean

protection from further attack. For instance, after one attack of chicken-pox the patient never catches the disease again, whilst pneumonia merely confers on the patient immunity from a fresh attack for about six weeks. No figures are available for the period of protection in glanders, but without new infection there will be no recurrence of the symptoms when once the man is cured.

### Occupation Diseases.

Glanders is found amongst men who work about horses, asses, and mules. Bacteriologists run some risk of infection, and veterinary surgeons, grooms, farriers, cabmen, etc., are apt to be exposed to the danger.

### Diagnosis.

In order to begin energetic treatment as early as possible, it is of vital importance to diagnose this disease from the first. This is required, not only for the patient's own safety, but for the safety of those with whom he may come in contact. The characteristic "glanders" nodules, taken in conjunction with the occupation of the patient, ought to suggest the diagnosis in cases of primary affection of the nasal mucous membrane and skin. It will be more difficult to make a diagnosis in those cases where the disease begins in internal organs, such as the lungs. Often a final decision cannot be arrived at until the patient has developed glanders of the skin or nasal passages, secondary to internal glanders, or until the presence of the *Bacillus mallei* is demonstrated.

Chronic glanders may sometimes be difficult to distinguish from tuberculosis and syphilis, but the history of exposure to infection from animals suffering from the disease will usually help in such cases.

The following are the important points:

1. The greatest and most satisfactory point in diagnosing glanders is the demonstration of the presence of the glanders bacillus. In a genuine case this is not a difficult or lengthy proceeding. A culture taken from the discharge on the affected surfaces and grown on potato will, in two or three days, assume the characteristic yellowish colour, gradually changing to a brownish tint.
2. Another good method is by the inoculation of guinea-pigs. A small quantity of the discharge is mixed with normal saline and injected into the peritoneal cavity of a male guinea-pig.

If it is a real case of glanders, the testicles of the guinea-pig will in two or three days become swollen and tender, and the skin over them will become reddened, and finally form matter, or suppurate.

3. **Mallein Test.**—A most valuable and almost infallible test is possible in suspected cases of glanders in horses, asses, or mules. A sterilized culture made in broth (called "mallein") is injected under the skin of the suspected animal, usually in the region of the neck. In those cases where glanders is present, a marked and steady rise of temperature and symptoms of fever follow the inoculation. Considerable local inflammation, which persists for two or three days (or more), also takes place at the site of the inoculation, whilst comparatively little or no inflammation occurs, if the animal is free from the disease. It is a test which, to be of full value, should always be done by a veterinary surgeon.

#### Malingering.

A malingerer cannot simulate the disease, but a man with syphilitic or tuberculous lesions may say he has been infected with glanders.

The demonstration of the presence of the *Bacillus mallei* clears up these cases.

#### Glanders and the Mallein Test in Animals.

It is universally recognized that, of all the domesticated animals, the horse tribe is the one most susceptible to glanders, the horse, ass, mule, and jennet, being most readily affected. This fact was recognized even in the days before Christ. Carnivorous animals may become infected from eating the flesh of diseased horses, and occasionally the goat and sheep catch the disease. Pigs are almost insusceptible, whilst cattle are immune altogether. The horse, then, is the animal which is to be most carefully watched, and it is for this reason that the disease is most commonly seen in stablemen, farriers, veterinary surgeons, and those whose daily work brings them in contact with the horse.

In the horse the disease used to be classified under the two headings—viz., "glanders" and "farcy." The former name was given when the lungs were affected, and the latter where the skin lesions were present. Modern veterinary pathology, however, classifies them both as "glanders," and does not admit of "farcy" as a separate disease.



When the lungs are severely affected, as a general rule the nasal septum and trachea are ulcerated or acutely congested, and there is usually a thin, glairy discharge from the nostrils, which sticks around the orifice, and may even be tinged with blood. The glands under the jaw, too, will generally be swollen. The horse's coat will probably be harsh and "unthrifty," and the animal may be emaciated, or what is termed a "bad doer." The appetite is generally good until near the end.

In the farcy form the lymphatics become "corded"; that is, a series of nodules or buds, running in a line consecutively after one another along the course of the vessel, appear on the leg. A favourite situation for these is the inside of the thigh or along the flank. Within a few hours these may burst and discharge a thin, glairy, fluid which is highly infectious. The thermometer forms a valuable aid to diagnosis, as the body temperature is usually persistently raised a degree or more; but a certain diagnosis can always be made within forty-eight hours (usually within twenty-four hours) by the use of mallein. A few drops of this material, injected under the skin, will give rise in a glandered horse to much constitutional disturbance, the temperature making a steady rise during the first eighteen hours, and then slowly falling again; whilst at the site of inoculation a very painful, well-defined swelling appears in a few hours. This, in a glandered horse, does not disappear for about forty-eight hours, or even more.

In a healthy horse there is no departure from normal either in respect to the body temperature or the local swelling. The use of mallein in the hands of a competent veterinary surgeon is almost infallible for diagnostic purposes, and by its judicious use it is possible within a very short time to absolutely eradicate all the glandered horses out of a stable. A further allusion is made to this valuable agent under the head of Diagnosis.

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## GLANDS—LYMPHATIC.

*See* VESSELS, LYMPHATICS.

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## HÆMORRHAGE.

*See* BLOODVESSELS.

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## HEAD.

*See* BONES, BRAIN, EYE, INSANITY, JOINTS, NEURASTHENIA, TEETH, ETC.

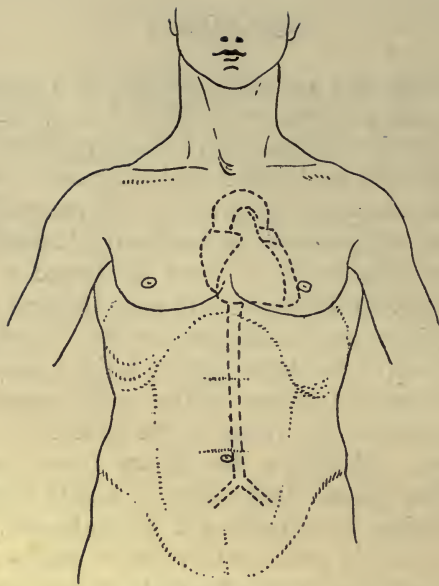


FIG. 95.—FRONT OF THE CHEST, SHOWING IN OUTLINE THE POSITION OF THE HEART.

The large right ventricle is seen in the middle, with the small right auricle above. The arched vessel is the large artery (the aorta) of the body, which passes downwards at the back of the chest and abdomen, giving off branches (which are not drawn), and divides into two below and to the left of the navel.

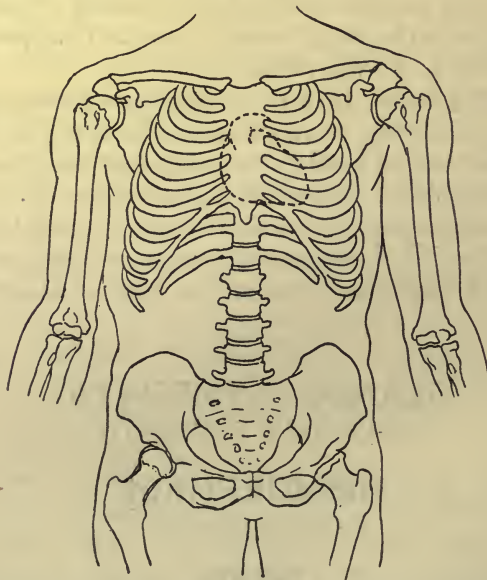


FIG. 96.—BONES AND HEART SEEN FROM THE FRONT, THE HEART BEING DOTTED IN OUTLINE.

Notice that the tip of the heart (the apex) lies in the fifth space, between the fifth and sixth ribs. This is the point where the heart-beat can be felt beating in health, and is known as the "apex-beat."

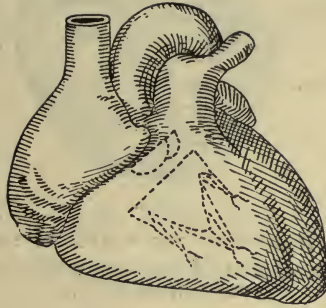


FIG. 97.—RIGHT SIDE OF THE HEART, DISTENDED AND DIAGRAMMATIC, SHOWING THE VALVES IN OUTLINE.

The large valves below are the tricuspid valves, which prevent the blood from regurgitating into the right auricle above. The smaller valves above are the pulmonary valves, at the mouth of the pulmonary arteries.

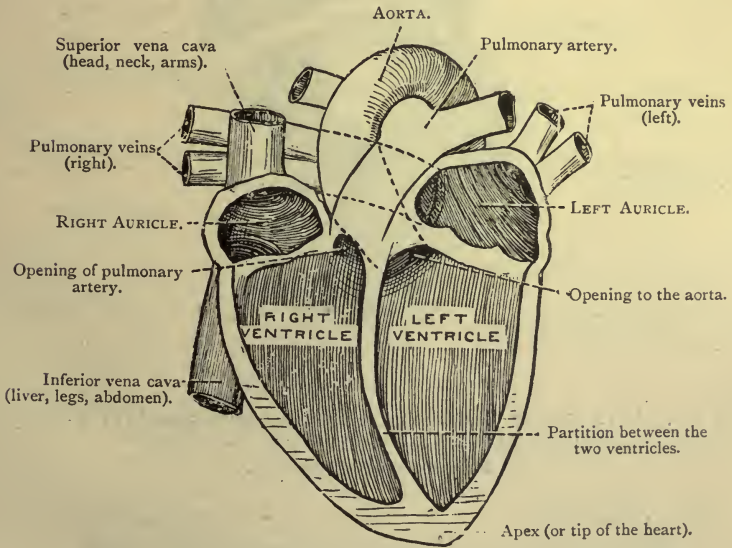


FIG. 98.—DIAGRAMMATIC VIEW OF THE FRONT OF THE HEART, OPENED, WITH VEINS (BRINGING BLOOD TO THE HEART) AND ARTERIES (CARRYING BLOOD FROM THE HEART) SHOWN.

The valves are removed.

(From Buchanan's "Anatomy.")

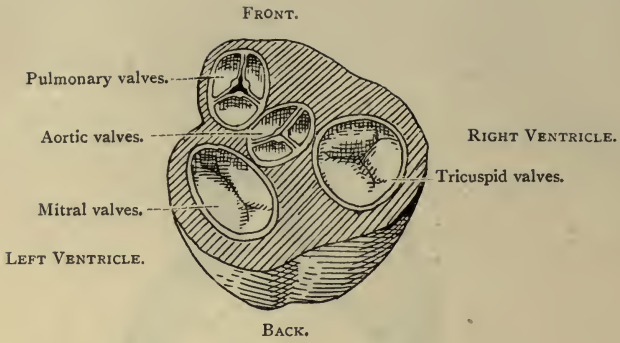


FIG. 99.—DIAGRAM OF THE VALVES OF THE HEART.  
The heart is represented as cut across the middle and displaying the valves from above.

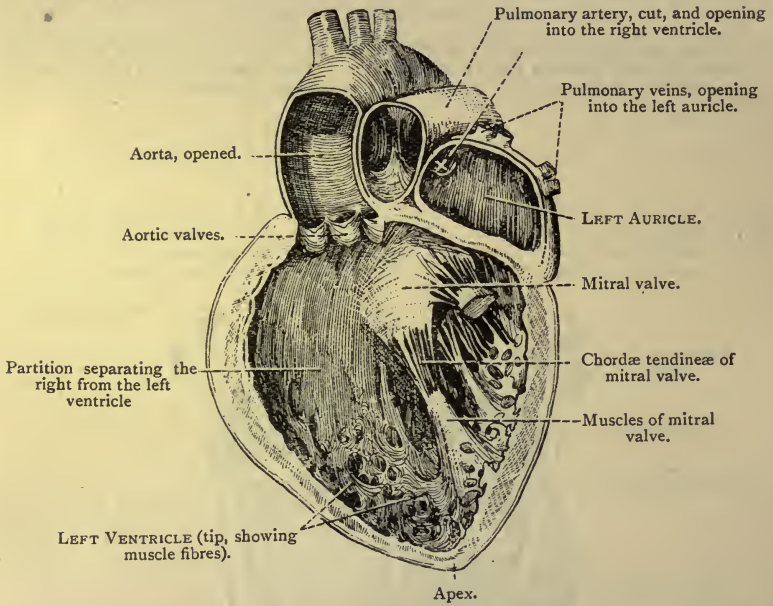


FIG. 100.—LEFT SIDE OF THE HEART, OPENED TO SHOW THE LEFT VENTRICLE AND AURICLE, WITH THEIR VALVES AND VESSELS.  
(From Buchanan's "Anatomy.")

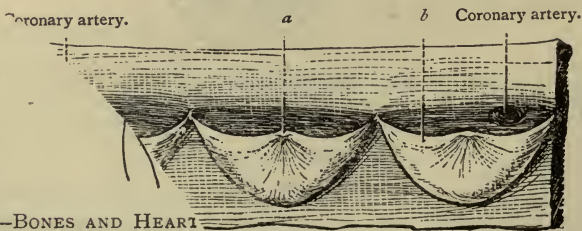


FIG. 96.—BONES AND HEART

DOT THE AORTA LAID OPEN AT THE LEVEL OF THE VALVES.  
Notice that the tip of the heart (the apex) is the point where the heart meets the sixth ribs. This is the point in health, and is known as the "apex."  
(From Buchanan's "Anatomy.")

# THE HEART.

By JAMES BERRY,

B.S., F R.C.S.

Surgeon to the Royal Free Hospital and the Mount Vernon  
Hospital for Diseases of the Chest,

AND

THOMAS D. LISTER,

M.D., M.R.C.P.,

Physician to the Mount Vernon Hospital and to the Royal  
Waterloo Hospital.

## Head-note.

THE vital results of accidents to the heart and its membranes are—

(i.) Bleeding.

(ii.) Shock.

## Technical Terms.

*Åneurism.*—A stretching and dilatation of an artery caused by disease, setting up a weakening of the wall. [Figs. 190, 191, 192.]

*Ångina.*—Also called “breast-pang” or “angina pectoris.” A pain in the region of the heart caused by a sudden straining and irregular action of the walls of the heart.

*Åorta.*—The main artery from the heart. [Figs. 95, 98.]

*Åörtic Valves.*—The valves of the aorta which prevent regurgitation of blood into the left ventricle. [Figs. 98, 99, 100, 101.]

*Åuricle.*—One of the two upper thin-walled cavities of the heart. (See Ventricle.) [Figs. 97, 98.]

*Brüt.*—An unnatural alteration in the normal sounds of the heart. The same as murmur.

*Chordæ Tëndinæ.*—Fibrous threads attached at one end to the heart wall, at the other near the edges of the mitral and tricuspid valves. They prevent the pressure of the blood on the valves from driving the edges too far. [Figs. 97, 100.]

*Còronäry Arteries.*—The small arteries that supply the heart muscle itself. [Fig. 101.]

*Effusion*.—An abnormal collection of fluid in the pericardium or other part of the body.

*Ĕndōcardĭum*.—The lining of the heart wall.

*Ĕndōcardĭtis*.—Inflammation of the lining of the heart wall.

*Hæmōpĕricardĭum*.—A collection of blood in the pericardium.

*Hĭdrōpĕricardĭum*.—A collection of fluid other than blood in the pericardium:

*Incompetence (Valvular)* } Faulty closure of the valves.  
*Insufficiency (Valvular)* }

*Mitral Valves*.—The valves between the left auricle and the left ventricle which prevent regurgitation of blood into the left auricle. (See Aortic Valves.) [Fig. 99, 100.]

*Murmur*.—See above, Bruit.

*Palpitation*.—Irregular and quick action of the heart.

*Pĕricardial Effusion*.—A collection of fluid in the pericardium.

*Pĕricardĭtis*.—Inflammation of the pericardium.

*Pĕricardĭum*.—The fibrous sheath which surrounds the heart. A trace of fluid lubricates its interior and allows free expansion and contraction of the heart. Increase of this fluid accompanies "pericarditis." [Fig. 137.]

*Pŭlmonary Vessels*.—The arteries and veins connecting the heart and lungs. [Figs. 98, 100.]

*Pŷōpĕricardĭtis*.—A collection of matter (pus) in an inflamed pericardium.

*Regurgitation*.—Blood returning back into a cavity of the heart the wrong way as the result of faulty closing of the valves. (See Valves—Aortic, Mitral, and Tricuspid.)

*Stĕnōsis*.—Narrowing.

*Sĭncōpĕ*.—Fainting.

*Tāchĭcardĭa*.—An unnaturally rapid pulse (100 or more beats per minute).

*Trĭcŭspĭd Valves*.—The valves between the right auricle and the right ventricle which prevent blood regurgitating into the right auricle. [Figs. 97, 99.]

*Vāgus*.—One of the chief nerves of the heart.

*Valves*.—Two or more crescents of a tough, thin, fibrous skin which allow blood or other fluid to pass in one direction only. If the blood attempts to return, the union of the valves closes the passage. (See above, Aortic, Mitral, and Tricuspid Valves.) [Figs. 97, 99, 100, 101.]

*Vĕntricle*.—One of the lower thick-walled cavities of the heart. (See Auricle.) [Figs. 98, 100.]

### Anatomy.

The heart is situated behind the breast-bone, in front of the windpipe and between the two lungs. [Figs. 95, 96.] It is a

hollow muscular organ whose function is to pump the blood through the body. It is divided into four cavities, each of which is furnished with valves, which regulate the direction in which the blood must flow. Of these four cavities, two are placed on the right side of the heart, and two on the left.

The two on the right side receive the impure blood returning from the body, and drive it on into the lungs; the two on the left side receive the purified blood from the lungs, and drive it again into the body. The cavities on each side are of two kinds: the larger thick-walled muscular pumping lower cavities called the "ventricles," and smaller thinner-walled upper cavities called the "auricles." [Figs. 95, 97, 98, 100.]

The cavities and openings of the vessels are guarded by valves, with the exception of the opening of the veins into the right auricle. The valves at the openings of the vessels are shaped like swallows' nests. [Figs. 99, 101.] The others are large membranous flaps; two between the left ventricle and left auricle constitute the mitral valve; three between the right auricle and right ventricle constitute the tricuspid valves. The free edges of these valves are supported by thin threads of fibrous tissue, which are attached below the valve to the muscular wall of the heart itself. These are called "chordæ tendineæ." Their purpose is to support the free edges of the valves so that they may not be everted by the force of the heart beat driving the blood against them and forcing the blood to regurgitate along the track it has just come, instead of travelling along the right vessel.

When these valves, through disease, congenital defects, or accident, become faulty, the blood then gets back through them, the result is "valvular incompetence," mitral, tricuspid, or aortic, according to the part of the heart affected. When, as sometimes happens, the valves become thickened and obstruct the entry of blood in the right direction, then "valvular obstruction" occurs. The obstruction may occur to any of the valves.

In each case of incompetence or obstruction, the heart sounds, as heard by the physician, are altered from their normal note, and a "bruit" or "murmur" is produced. Bruits and murmurs occur also in anæmia, however, when there is no affection of the valves.

The heart is enclosed in a bag or membrane, called the "pericardium," which is furnished with a smooth lining to permit of the free movement of the heart within it. In the healthy individual the pericardium contains a little clear fluid,

sufficient to allow of the movement of the heart without friction. As a consequence of disease this fluid may be increased, and may form matter, or may disappear and leave adhesions by which the heart is united to the pericardium.

### Consequences of Accident.

The principal accidents which can occur to the heart are—

- (a) Contusions.
- (b) Wounds, punctured or gunshot.
- (c) Dilatation.
- (d) Ruptured valve (from strain).

(a) **Contusion.**—A blow on the heart may cause contusion, producing temporary faintness, which generally passes off in a few hours, or at the most a few days.

(b) **Wounds.**—A penetrating wound of the heart in either of its cavities is generally quickly fatal, from accumulation of blood in the pericardium around the heart, preventing it from moving. Punctures by small pointed bodies, such as needles, pins, fish-bones (from the food-pipe), may not be immediately fatal, but generally lead in the end to death from bleeding and inflammation.

The immediate effect of a small wound of the heart is collapse. Occasionally a bullet has been found to lodge in the heart and remain there for months or years. When such a small object is lodged in the heart wall, it generally, but not always, causes death by later inflammation.

Small wounds which do not penetrate into any of the cavities of the heart produce fainting. If unaccompanied by bleeding and not followed by inflammation, the patient may recover. (See Operation.)

(c) **Dilatation**, or sudden stretching of the muscular walls of the heart, occurs as the result of violent or prolonged muscular efforts. The results are palpitation, angina pectoris, shortness of breath, and the physical signs of dilatation of the heart. The effects of a severe dilatation may persist for many years, involving permanent weakness of the heart, with recurrent palpitation on slight exertion.

(d) **Rupture of the Valves.**—This affects almost exclusively the aortic valves [Figs. 99, 101]. It is very rare, but may occur in diseased valves from sudden violent exertion. The result will be faintness, pain in the region of the heart, often localized over the ruptured valve, shortness of breath, and physical signs of in-



complete closure of the valve. This injury produces permanent "heart disease."

### Disease.

1. **Produced by Accidents to the Heart** (in addition to the effects of contusion and wounds already referred to above).—**Dilatation** usually affects the left ventricle, and weakens its action as a first consequence of the strain. The strain in question is, most commonly, excessive muscular effort, such as weight-lifting or violent athletic effort. Later, owing to the diminished flow of blood through the heart and the congestion and retardation of blood in the lungs, secondary effects are produced in the lungs, such as bronchitis and blood-spitting. Owing to dilatation the valves can no longer meet, and then backward pressure through these incompetent valves affects the other cavities of the heart, which also become dilated secondarily.

**Ruptured Valve.**—When rupture affects the aortic valves, as is usually the case, the secondary consequences are identical with those of aortic incompetence arising from disease. The more remote effect is that of dilatation of the heart, and is produced sooner or later, according to the amount of strain put upon the heart.

2. **Existing before the Accident and aggravating its Effects.**—Existing heart disease is accentuated by dilatation from strain. Diseased valves may rupture under a strain or accident.

If the heart be already diseased, the effects of any accident to the heart are more severe and lasting.

Malnutrition and bloodlessness (anæmia) both increase the immediate risks of dilatation and diminish the power of recovery, as do syphilis, kidney disease, and excessive indulgence in tea, coffee, and tobacco, and more especially alcohol.

### Operation.

Operation for accidents to the heart can only be undertaken—

(a) For wounds of the heart.

(b) For the removal of foreign bodies or effusions from the pericardium.

(a) **For Wounds of the Heart.**—Operations for injury to the heart can only be undertaken in certain desperate cases of wounds not immediately fatal. The object is to sew up the wound and prevent further escape of blood. All operations on the heart are exceedingly dangerous.

(b) **For the Removal of Foreign Bodies or Effusions from the Heart-Sheath (Pericardium).**—Operations on the pericardium are undertaken to relieve pressure of fluid, such as matter (pus), blood, or clear fluid, or to remove a foreign body.

Such operations, although serious, are much less dangerous than those upon the heart itself.

In the above cases the risks are increased by undue delay.

### Cure.

In the few cases in which operations upon the heart are followed by recovery, the patient may be completely cured, or he may be left with a more or less embarrassed heart. Even in the most successful cases, many weeks must elapse before the patient may be allowed to move about. In most cases of operation upon the pericardium, many months must elapse before the patient will be fit for even light work.

In cases of contusion followed by recovery no subsequent danger exists, and the patient may be considered to be well as soon as the effects have passed off. In cases of ruptured valve the patient becomes the subject of permanent valvular incompetence, and is never completely cured. At the best he will only be fit for a light sedentary occupation.

### Return to Work.

The time for return to work is about the same as for cure. In many cases of heart disease the man will be permanently incapable of hard work for the rest of his life.

Mitral valve disease does not usually hinder a young man from following his occupation, unless that be very heavy. Mitral disease is almost always the result of rheumatism, and not of accident. We do not recollect a case of mitral or tricuspid valvular incompetence which was due to accident.

The capacity to return to work depends upon the amount of dilatation that persists. Well-marked dilatation prevents a man from doing laborious work, which will constantly tend to dilate the heart yet further.

### Recurrence.

The risk of recurrence exists only in cases of dilatation from strain. A dilatation that has become cured is liable to recur from any undue exertion, even though the exertion be of a much slighter degree than that causing the first dilatation.

### Occupation Diseases.

Occupations involving great and irregular muscular exertions, with variations of temperature or atmospheric pressure, are especially liable to cause dilatation of the heart, affecting particularly the left ventricle.

This dilatation may be general, or it may involve one part of the heart wall, leading to a local bulging and thinning (cardiac aneurism).

### Diagnosis.

The physical signs of dilatation and of ruptured valve which arise from accident are identical with those due to pre-existing disease. With a view to obtaining compensation, an accident may be alleged by a patient who is really only suffering from pre-existing disease.

The physical signs, although identical in disease and accident, are far more likely to have been caused by disease in the following cases :

(a) If there is a history of some illness likely to have caused heart disease—*e.g.*, joint pains in youth, rheumatism, or rheumatic fever (especially repeated attack), St. Vitus's dance (chorea), influenza, or even, though rarely, any other acute fever.

(b) If there is evidence of chronic kidney disease.

(c) If the valves affected are the mitral or tricuspid valves, the condition is probably due to disease, as these valves are hardly ever ruptured by accident.

### Malingering.

Malingering of heart disease may be detected by the absence of any physical sign, such as alteration in the size of the heart, murmurs, irregular pulse, and unnatural action of the heart.

In cases where nervousness under examination causes some such abnormal action, skilful and repeated examination both in the erect and recumbent position during distraction of the patient's interest and attention will disclose the presence or absence of real disease.

Excessive tobacco-smoking causes irregular heart-beat, which may be attributed to disease caused by accident; and men have been known actually to take drugs that they knew would disturb the heart, but these were usually well-educated malingerers.

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*For legal cases of injury to the Heart, see CASE GUIDE: Heart.*

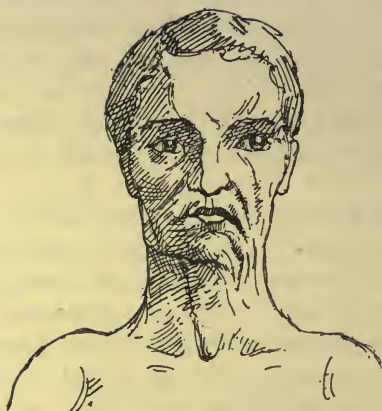


FIG. 102.—BURN OF THE LEFT SIDE OF THE FACE AND NECK, WITH SUBSEQUENT SCAR, WHICH CONTRACTED AND DISTORTED THE PARTS, PULLING DOWN AND FIXING THE CORNER OF THE MOUTH.

# HEAT.

By J. M. H. MACLEOD,

M.A., M.D., M.R.C.P.,

Physician for Diseases of the Skin to Charing Cross Hospital and Victoria Hospital for Children ; Lecturer on Skin Diseases, London School of Tropical Medicine ; Co-Lecturer on Skin Diseases, Charing Cross Hospital Medical School ; Editor of "The British Journal of Dermatology."

## Head-note.

THE dangers arising from heat are—

1. Contractions of the scar resulting from healed burns.
2. Shock.
3. Heat-stroke.

## Technical Terms.

*Āsphÿxiā*.—See Heat Asphyxia.

*Dermātītis*.—Inflammation of the skin.

*Ērythēmā Sōlāre*.—Red patches on the skin caused by the sun's rays.

*Freckles*.—Yellowish-brown pigmented spots on the skin, usually produced by sunlight, but which can also be caused by heat.

*Heat Āsphÿxiā*.—Suffocation, or failure of respiration, due to heat.

*Heat Sÿncōpē*.—Failure of the heart's action due to heat.

*Hÿpērpÿvëxiā*.—Very high body temperature—106° F. and over.

*Sÿncōpē*.—See Heat Syncope.

## Anatomy.

The anatomy of the skin is described in the article on Skin.

Where death has taken place from heat-stroke, the skin may be livid and marked by small hæmorrhages ; the other signs are those of death by asphyxia.

Where recovery has supervened, there are no definite anatomical peculiarities, the most pronounced changes affecting

the central nervous system, and being largely functional in character.

### The Consequences of Exposure to Heat, etc.

Heat may produce local effects on the skin, and general or constitutional effects.

1. Local effects on the skin (burns) may be caused by—

- (a) Heat, whether moist or dry.
- (b) Corrosives.
- (c) Sun-rays.
- (d) Electricity. (See Electricity, p. 259.)
- (e) Röntgen rays. (See X Rays.)
- (f) Rays from radio-active substances, such as radium.

2. Constitutional effects in parts remote from the seat of injury occur:

- (a) As a consequence of the involvement of the skin.
- (b) As a direct effect of the sun and heat.

1. **Local Effects.**—(a) *Heat, whether Moist or Dry.*—Burns and scalds are produced by the action of excessive dry or moist heat on the skin. They vary with the degree of heat, the length of time the skin is exposed to it, and the manner in which the burn is produced. It is customary, after the French surgeon Dupuytren, to describe the effects of excessive heat as burns of six degrees. This division, which is purely arbitrary, is useful in emphasizing certain points in which burns differ according to the degree of heat.

(i.) Burns of the first degree are caused by a temperature of about  $60^{\circ}$  C., and consist of a mild redness (erythema), which disappears quickly. A transudation of fluid into the tissues and swelling (œdema) may occur, associated with pain and tenderness. This may last for a few days, and on its subsidence scaling generally takes place.

(ii.) Burns of the second degree are caused by a temperature of about  $75^{\circ}$  to  $100^{\circ}$  C., and are followed by a painful inflammation, with marked transudation of fluid into the skin. Either at once or in the course of a few hours the affected skin becomes raised into a bleb. The bleb is readily broken by injury or by increased exudation into it, and when this happens a scab forms, beneath which scarring may take place. Occasionally the fluid in the bleb becomes absorbed, and the bleb collapses without breaking. Under favourable conditions healing takes place without a scar being left. Scarring is

liable to result if the burn becomes infected with organisms producing pus and ulceration.

(iii.) Burns of the third degree are produced by a temperature greater than  $100^{\circ}$  C. In this case not only the epidermis, but also the deeper layer of the skin is involved and destroyed; the dead piece of skin is known as the "eschar." The eschar is firmly adherent to the underlying tissue, is ashen grey or black in colour, and leathery in consistence. It early becomes surrounded by an inflammatory halo, and in a few days matter is formed at the edges and a painful inflammation sets in. In a week or two the eschar sloughs off. Slight contraction may occur in the scars which follow.

(iv.) In burns of the fourth degree the skin in the whole of its depth is involved; consequently, where the eschar separates cicatrization commences, and irregular scars and unsightly contractures are produced.

(v.) In burns of the fifth degree not only the skin, but the underlying tissue and muscles are involved.

(vi.) In burns of the sixth degree the carbonization effects the whole thickness of the part, including the bone. Such a severe accident is extremely rare, occurring occasionally in the case of a finger or toe.

(b) *Burns from Corrosives.*—Burns may be caused not only by excessive heat, but also by a number of corrosives, such as strong acids or caustic alkalies. Of these the most common are nitric, sulphuric, hydrochloric, and carbolic acids, "Greek fire" (phosphorus dissolved in carbon bisulphide), lime, caustic potash, and silver nitrate. On the skin they cause an inflammation which is usually associated with staining, the colour varying with the different corrosives. Where the corrosive is strong, ulceration occurs afterwards. Burns from corrosives differ from those caused by heat, in that blistering (vesication) is absent except in the case of those caused by "Greek fire"; they are not so varied in degree (multiform) as those caused by fire. The skin is stained yellow where the burn is caused by nitric acid, reddish or dirty brown from sulphuric acid or caustic alkalies, and grey or whitish from carbolic acid.

Burns from corrosives are difficult to heal, and may produce great disfigurement.

(c) *Sun-Ray Burn.*—Exposure to the sun's rays, especially in individuals with a sensitive skin, produces red patches, known as "erythema solare." This redness is accompanied by more or less itching; if the exposure be prolonged, a severe inflamma-

tion of the skin (vesicular or bullous dermatitis) may result, associated with smarting and burning sensations. It yields slowly to treatment, and, if the broken surface be infected with pus-producing organisms, is liable to be succeeded by scarring.

Repeated exposure to the sun's rays causes freckles and a gradual pigmentation of the exposed skin. At one time it was thought that the erythema and dermatitis were caused by the action of the heat rays of the sun, but they are now known to be due to the chemical or actinic rays—namely, those at the violet end of the spectrum. The dermatitis may readily be produced by the sun's rays in the cold, as, for example, in mountaineering in the snow.

(d) *Electric Burns*.—See Electricity.

(e) *X-Ray Burns*.—See X Rays.

(f) *Radium Burns and Burns from Radio-Active Substances*.—

Burns from radium resemble those from X rays, and are of the same intractable nature, taking months to heal. (See X Rays.)

2. **Constitutional Effects of Heat.**—(a) *As a Consequence of the Involvement of the Skin*.—The constitutional effects of burns vary with the skin area involved and the situation, and are far more severe than after other injuries which involve an equal destruction of the tissues, but less skin. Burns involving about one-half of the skin surface are usually fatal, death resulting from shock a few hours after the burn, the patient dying in a state of profound collapse. Sometimes the patient may remain comparatively well during the first twenty-four hours, except for the local pain, and then gradually succumb, with symptoms of prostration preceded by spasms, restlessness, and pain and distress over the region of the heart. Should prostration be delayed for forty-eight hours or longer, the prognosis becomes more favourable. On the other hand, the stage of collapse may be safely passed through, and yet the patient be in danger from acute inflammatory symptoms supervening as a result of the extension of the inflammation of the external organs, especially the lungs, kidneys, peritoneum, duodenum, etc. (See below, Disease.)

(b) *As a Direct Effect of Sun and Heat*.—The effect of exposure to the rays from a powerful sun, or to intense heat from any source, may be the production of the condition known as "sunstroke" or "heat-stroke."

Sunstroke may be caused, not only by the direct rays of the sun, but also by reflected rays from water, or even from such a surface as a bright white road.



The sunstroke may be of a mild type, and be followed by no serious sequela, complete recovery taking place a day or two after the attack. In severe cases, however, a fatal issue is not infrequent; and where recovery does take place, it is apt to be imperfect, and the health to be seriously impaired.

An attack of heat-stroke is usually followed by a marked intolerance to heat, so that the affected individual cannot endure exposure to the sun, and may be rendered incapable of living in a hot climate or working in a warm environment. Three different types of heat-stroke have been described by the late Sir Joseph Fayrer:

- (a) A type in which failure of the heart's action occurs—heat syncope.
- (b) A type in which the respiratory function fails and a condition of profound shock occurs—heat asphyxia.
- (c) A type in which the most pronounced feature is a high body temperature, or hyperpyrexia, the fever sometimes reaching 106° F.

In the syncopal type, which is sometimes known as "heat-exhaustion," death may take place from heart failure. Fortunately, many such cases recover. A common cause of the heat-stroke may be great exertion in an overheated atmosphere, either caused by the sun's rays or artificial heat.

In the asphyxial type, or true sunstroke, the cause is the direct rays of the sun beating down on the exposed head or spine. In these cases death may result suddenly from failure of respiration and circulation. Recovery may take place, but it is liable to be an imperfect one, and associated with permanent disorder of the nervous system and impairment of intellect.

In the hyperpyrexial type the cause is intense heat from any source. It not infrequently occurs in hot nights, in soldiers exhausted by long marches or disease, and crowded together in a stifling atmosphere. It is liable to occur among stokers and workers in any hot environment, and more especially as the result of damp heat. The mortality is very great in this type. Recovery may take place, but it is apt to be succeeded by enfeebled health.

After all varieties of heat-stroke intolerance to the sun's rays and slight degrees of heat is established, which may persist for years or indefinitely, and predisposes to recurrence.

### Disease.

1. **Caused by the Accident.**—The diseases are of two kinds, the one affecting the skin, or local, and the other general, or at a distance from the injured part.

(a) *Skin Disease the Result of Burns.*—The formation of matter and ulceration in the case of deep burns is common, and may delay healing for some time, and result in the formation of unsightly contractions and scars. [Fig. 102.] Even after slight burns a wrinkled edge and shallow scar may be expected. There is nothing special to distinguish the scars from different kinds of burns, except that burns from corrosives, as has been mentioned, are more likely to cause scarring than burns of about the same degree from heat. A later change of the scar, called “cheloid,” occurs sometimes; this is fully described under Accidents to the Skin. (For local injuries caused by contraction of scars, see Eye, etc., p. 316.)

(b) *At a Distance.*—Burns, especially in children, over the chest, abdomen, or head, cause inflammation of the lining parts underneath. The lining of the chest wall (pleura) is inflamed and causes pleurisy; the lining of the abdomen (peritoneum) is inflamed and causes peritonitis; and the lining of the skull, or rather the covering of the brain, is inflamed, causing meningitis. These are very serious results, and any one of them may be fatal.

The commencement of the small intestines is called the “duodenum,” and occasionally after a burn an ulcer is said to occur there. The kidneys may be also involved, and blood be found in the urine.

2. **Existing before the Accident and aggravating its Effects.**—The previous existence of any skin affection, such as eczema or psoriasis (see Skin), may aggravate the effects of a burn.

Any debilitating condition or disease, such as alcoholism, fatigue, malaria, or tuberculosis, may increase the constitutional effects of a burn, or render the individual more susceptible to heat-stroke; and, conversely, an attack of heat-stroke may aggravate such pre-existing diseases.

### Operation.

Operations are frequently required to promote rapid healing, or to correct the contractions which result in the healing of burns. The operation may consist of grafting living human

skin on to the burnt area, to encourage rapid healing, and to prevent, as far as can be, contractions.

In other cases, where the scars have distorted the body by fixing muscles and other movable parts in new, uncomfortable, or useless positions, it may be advisable to divide them or to excise them, and replace them with skin-grafts. A common instance of this is where, through a burn on the face, a scar forms, which drags down and everts the lower eyelid, causing continuous running of tears down the face, and great misery, inflammation, and disfigurement.

### Cure.

1. **The Skin.**—The time taken for cure depends on the amount and the depth of the area involved and on the general condition of the patient.

Burns of the first degree heal readily in a few days, but the shock, where the area of skin injured is extensive, may be so great that considerable delay, especially in children, may take place before the injured person is well.

Burns of the second degree take longer to heal, and should suppuration occur, further delay will be caused.

Burns of the third and fourth degrees or from corrosive fluids may take long to heal. Contractures, as a rule, follow, and, if not corrected, tend to get worse.

Burns of the fifth and sixth degree, if they involve the trunk and if of any great extent, are almost invariably fatal. Should the limbs be the seat of injury, amputation is as a rule necessary.

2. **Constitutional Injuries.**—Where recovery takes place after sunstroke, the cure may be rapid or tedious, and in rare instances may necessitate prolonged rest and the avoidance of exposure to sun and heat. (But see Return to Work.)

### Return to Work.

1. **The Skin.**—The capacity for return to work depends on the completeness of the healing and the amount of contracture. Disfigurement will prevent some men, as waiters, from getting work, and contractures, which tend to get worse for some time rather than better, may render an arm or leg partially useless.

2. **Constitutional Injury.**—An attack may be completely recovered from in a few weeks, and the patient enabled to

return to work, provided his occupation does not necessitate exposure to heat. Should it do so, it may be years before the intolerance to heat is got over.

Sunstroke is exceedingly common in the tropics, especially in the slight form. "A touch of sun" is a complaint that few old residents have escaped.

### Recurrence.

There is no risk of recurrence of the effects of a burn. Individuals who have once suffered much from sunburn are more liable to suffer from it again.

The risk of recurrence is very great if a patient who has had heat-stroke again exposes himself to heat.

### Diagnosis.

1. **The Skin.**—The diagnosis of a burn of the first degree is always possible from the fact that the hairs on the exposed parts are also burnt.

The same applies to burns of the second and third degrees. Blisters from other causes, such as steam friction and certain skin diseases, notably pemphigus, resemble those caused by burns; but the blisters of pemphigus tend to appear anywhere on the skin, in situations where there has been no burn.

2. **Constitutional Injury.**—There is little difficulty in recognizing a heat-stroke from other diseases, on account of the presence of one or other of the characteristic symptoms, such as shock, exhaustion, respiratory failure, coma, convulsions, high fever, in association with a powerful sun or intense heat.

### Malingering.

1. **The Skin.**—The malingerer by burns from heat has probably burnt himself to a slight degree, but the process, being rather painful, is not a common form of extorting compensation or damages. The application of corrosives, especially the strong acids, such as nitric acid and hydrochloric acid, is a common method of malingering.

2. **Constitutional Injury.**—Malingering in this connection would only be liable to occur where various ailments, due perhaps to other causes, might be said to be the result of heat-stroke. Detection of malingering in such a case may present

great difficulties, as the symptoms are likely to be of a vague nervous type which may tax the skill of an expert in diagnosing.

### **Criminal and Self-inflicted Wounds.**

The commonest form of criminal burn is by vitriol-throwing. Vitriol is the strongest sulphuric acid, and burns like molten metal, turning the skin into a black eschar at once. This is more common in other countries than in England, and the scars remaining are of the most terrible kind.

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*For legal cases of Injury by Heat see CASE GUIDE: Heat.*

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### **HERNIA.**

*See* RUPTURE.

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### **HOUSEMAID'S KNEE.**

*See* BURSÆ.

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### **HYDROPHOBIA.**

*See* RABIES.

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### **HYSTERIA.**

*See* NEURASTHENIA, INSANITY.

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### **IMMUNITY.**

*See* INFECTION.

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### **INFANTS.**

*See* CHILDREN.

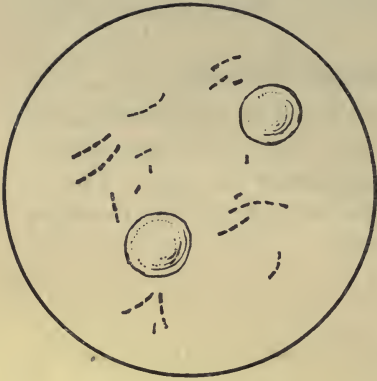


FIG. 103.—RELATIVE SIZE OF RED BLOOD-CORPUSCLES (THE TWO CIRCULAR DISCS) AND TUBERCLE BACILLI.

The diameter of a red blood-corpuscule is  $\frac{1}{2500}$  of an inch.



FIG. 104.—COCCI WHICH, FROM THEIR DIVIDING ALWAYS IN THE SAME DIRECTION, ARE ARRANGED IN CHAINS.

These are streptococci, a form which is frequently found in erysipelas and other forms of spreading infections.

(From Rose and Carless's "Surgery.")

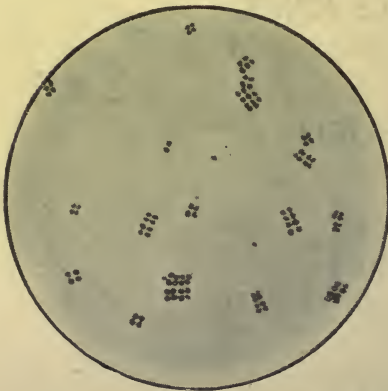


FIG. 105.—COCCI WHICH, FROM THEIR DIVIDING IN ALL DIRECTIONS, ARE ARRANGED IN CUBICAL COLLECTIONS, RESEMBLING A BALE OF WOOL TIED BY CORDS IN THREE DIRECTIONS.

(From Rose and Carless's "Surgery.")



FIG. 106.—TUBERCLE BACILLI: A MICROSCOPICAL SLIDE OF "SPUTUM," OR EXPECTORATION, CONTAINING TUBERCLE BACILLI.

(From Rose and Carless's "Surgery.")

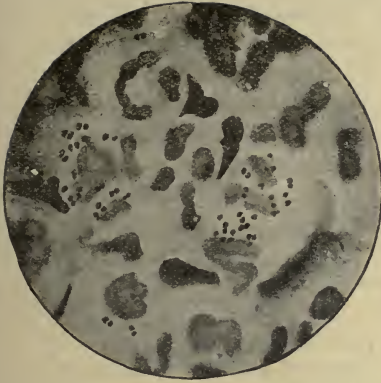


FIG. 107.—GONORRHEA: THE MICROBE, OR GONOCOCCUS, IN THE DISCHARGE OF THE DISEASE.

Small kidney-shaped bodies arranged in pairs.

(From Rose and Carless's "Surgery.")

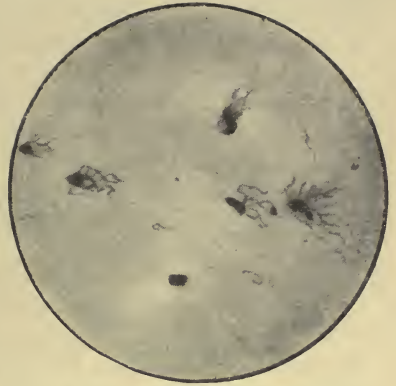


FIG. 108.—BACTERIA OF TYPHOID FEVER: BACILLUS TYPHOSUS.

These bacilli have numerous minute threads (flagella) attached to their surfaces, by the rapid movement of which the bacilli progress.

(From Rose and Carless's "Surgery.")

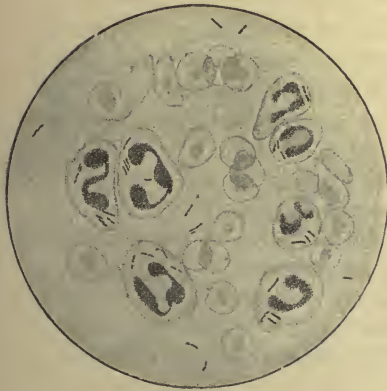


FIG. 109.—PHAGOCYTOSIS, OR ABSORPTION AND DESTRUCTION OF THE BACTERIA OF TUBERCULOSIS BY LARGE WHITE BLOOD-CORPUSCLES IN THE BLOOD.

(From Rose and Carless's "Surgery.")



FIG. 110.—PYEMIA: OPENED VEIN WITH A TRIBUTARY, WHICH CONTAINS A DISINTEGRATING BLOOD-CLOT, FROM WHICH FRAGMENTS HAD BEEN BORNE IN THE BLOOD-STREAM, SETTING UP A GENERAL PYÆMIA, WHICH PROVED FATAL.

(From Rose and Carless's "Surgery.")

# INFECTION.

By G. LENTAL CHEATLE,

C.B., F.R.C.S.,

Surgeon to King's College Hospital; Teacher of Practical Surgery  
in the King's College Hospital Medical School;  
Surgeon to the Italian Hospital.

## Head-note.

By "infection" is meant—(1) The communication of disease due to micro-organisms; (2) the virus or poison containing the actual infecting agent by which the disease is communicated.

## Technical Terms.

*Agglutinātion*.—An altered condition of the blood in disease by which its fluid part, serum, when added to micro-organisms of the same kind as that which produced the particular disease, causes the micro-organisms to collect in masses, or agglutinate. (See Ptomaine-Poisoning.)

*Agglutinātion Test*.—See Ptomaine-Poisoning.

*Ānyloid Disease, or Lardaceous Disease*.—A degenerative condition of the cells of the body caused by the presence of the poisonous products of certain bacteria. (See below, Disease, p. 449.)

*Āntibodies*.—Substances produced in the body during the course of any infection. They are antagonistic to the life of the bacteria which caused the infection, and include lysins, agglutinins, opsonins, antitoxines, etc.

*Āntitōxine*.—One of the antidotes to the poisonous products, toxines, of the bacteria of infection. Is produced during the course of an infection, and neutralizes the toxines.

*Disease*.—See Infection.

*Ēmbōlūs, Embolism*.—A fragment of blood-clot, fat, growth, or even a mass of micro-organisms, any of which may be circulating in the blood-stream, by which it is carried to another part of the body. An embolus which is dislodged from a vein is carried to the heart, and is eventually impacted in the lungs. An embolus from an artery may be deposited anywhere in the body. In some instances the embolus



starts from one of the branches of the big vein, the portal vein, which drains the blood from most of the organs in the abdomen. As this vein ends in the liver, it is in this organ that the embolus will be caught. (See Pyæmia, p. 448.) [Figs. 110, 194, 195.]

*Immunity.*—The condition of an individual who is incapable of being rendered ill by the particular micro-organisms by which he is being attacked. It is of two kinds: the one natural, where for some unknown reason a human being is not susceptible to a particular disease; and the second acquired, where, owing to having successfully passed through an attack of the disease, the person has developed the power of resisting the particular micro-organisms which caused that disease. Of natural immunity, an example in the lower animals is a frog, which is naturally immune to anthrax bacillus, whilst a guinea-pig is naturally susceptible. Of acquired immunity, the micro-organisms of most of the fevers, such as typhoid fever, are rarely able to cause a second attack of this disease. In course of time this acquired immunity may become lowered, and it varies for each micro-organism, and even in different individuals; for instance, the protection from an attack of erysipelas only lasts for a few weeks. That of typhoid fever and smallpox is usually lifelong.

*Incubation Period.*—The time elapsing between the infection by the bacteria and the first symptoms of the disease caused by the bacteria.

*Infection.*—The entry into the human body of micro-organisms capable of producing disease. The infectious disease is the altered condition of the body consequent on the establishment and growth of the micro-organisms.

*Leucocytosis.*—When the infective process is not so acute and the body is reacting—that is, resisting the infection—there is a marked increase in the number of certain white blood-corpuscles (polynuclear leucocytes); this is called a “leucocytosis.” On the contrary, should the body cease to react—*i.e.*, when the poison gets the upper hand—the number of leucocytes, compared with normal, is diminished. This condition is termed “leucopenia.”

*Mixed Infection.*—An infection caused by more than one type of micro-organism, as contrasted with pure infection, where only one type of micro-organism is causing the condition.

*Ōpsōnīn.*—Among the antibodies a substance (opsonin) is developed during the course of an infection which is hostile to the growth and life of the bacteria causing infection. Its presence is a proof, and may be used as a test for the particular bacteria.

*Phāgōcītōsis.*—The absorption and destruction of bacteria by some of the white corpuscles of the blood. [Fig. 109.]

*Portal Pyæmiā.*—See Embolus.

*Portal System of Veins.*—The veins which drain the blood from most of the abdominal organs and empty into the liver.

*Pure Infection.*—See Mixed Infection.

*Puerperal Fever.*—Puerperal fever is an infection occurring in the female generative organs, usually within a month of the delivery of child. It is caused by micro-organisms, and may be of the nature of a *sapræmia*, *septicæmia*, or even *pyæmia*.

*Pyæmiä.*—A disease in which numerous small abscesses are formed all over the body. It is caused by the breaking up in a vein of a blood-clot which has become infected by micro-organisms. Particles of the clot are conveyed to the heart and lungs, from which they may be scattered all over the body and may again produce abscesses. [Fig. 110.] If the infected clot is in an abdominal organ, the infection from it may be in the liver. This is called “portal *pyæmia*.”

*Säpræmiä.*—The condition caused by the absorption of the poisonous products of bacteria which have infected a wound, in contrast with the absorption of the bacteria themselves—of two kinds: (1) Caused by micro-organisms capable of living in a wound on the dead tissue—septic intoxication; (2) caused by micro-organisms capable of existence in a wound on living or dead tissue—traumatic fever. (See below, *Septicæmia*, *Hectic Fever*.)

*Sëpticæmiä.*—The absorption from a wound of living bacteria, which multiply and produce their poisons (toxines) in the blood and tissues of the body. (Contrast *Sapræmia*, above.)

*Thrömbus, Thrömbösis.*—A clot which forms in an artery or vein is called a “thrombus.” When part or whole of it becomes separated, it may form an embolus. (See *Embolus*.) [Figs. 194, 195.]

*Toxines.*—The poisonous products of bacteria by means of which various symptoms of disease are produced. They are either produced mainly at the seat of inoculation, as in an acute abscess, or generally in the blood and tissues of the body, as in *septicæmia*.

*Traumatic Fever.*—A condition associated with fever caused by the absorption of the products produced by the growth of micro-organisms on living and dead tissues in a wound.

### Nature of Infection.

An infection is the entry of bacteria into the body; an infectious disease is the altered condition of the body consequent upon their establishment and growth.

Among the micro-organisms producing disease are—bacteria and bacilli (rods), and cocci (spheres). These are all popularly known as “bacteria,” and in the popular sense the word is used here. There are other micro-organisms producing disease, which are not usually known as bacteria, such as those causing malaria.

For infection, all that is required is the entry of the bacteria capable of producing a diseased condition. Whether or not they will succeed in producing disease depends upon many features discussed below.

The micro-organism has enormous powers of multiplication. One parent by simple division of its substance makes two children. These grow to their full size, and each then repeats the process of division, so that from one bacterium, by division followed by growth and further division, in quite a short time millions of descendants are produced. Some bacteria multiply more slowly than others.

Their food may be chemical, animal, or vegetable, and, of those that infect the human body, one kind lives on dead animal matter, blood-clot, etc., only, another principally on the living tissues of the body.

**Toxines.**—During the activity and growth of bacteria various substances are produced, which are, in some cases, the poisons inducing the symptoms of the disease. These poisons are called “toxines,” and this word includes many other substances to which it is not necessary now to refer.

The poisonous symptoms depend on the dose and on the nature of the poison. A small dose of some toxines is enough to kill; a large one of other toxines is less harmful. In addition, the effect of each poison upon a patient will depend on his immunity, or power of resistance to the toxine.

**Immunity.**—Immunity is natural or acquired. It is natural in some animals which are not susceptible to a bacterial poison which kills other animals.

Immunity and susceptibility may be of local nature; that is to say, previous injury may render particular parts more susceptible to infective processes than the rest of the body.

Immunity to an infection is acquired in consequence of an animal having been once attacked by the infection, and having successfully overcome it. The acquired immunity of an individual is a process which may begin as soon as the poison is produced in the body by the bacteria. The toxines, the bacterial poisons, incite the resistance of the body, which produces in consequence “antitoxines” to neutralize the toxines. So that a struggle occurs from the very first, and continues as long as both bacteria and the patient survive. On the one hand, a few or harmless bacteria may enter the body producing a trivial infection, which the body overcomes. On the other hand, a more serious infection occurs, and the bacteria grow, live for a

time, produce disease, and kill the patient, or are eventually overcome after a struggle. The duration of the conflict varies : in the case of a small abscess it is short ; in the case of typhoid, glanders, etc., it may be long.

**Incubation Period.**—Time is required for all these poisons to act. There is always a period of incubation, or time during which the bacteria are gradually overcoming the local or general resistance of the body, until “symptoms” of the local or general disease appear. This period, known as the “incubation period” or “latent period,” is fairly well known for many diseases. It is of great medico-legal importance, as by it the date upon which the infection occurs can be fixed with some limits. For example, the incubation of erysipelas is from a few hours to two days after inoculation.

If it is claimed that an infection has occurred on a particular date, then as the date when the symptoms appeared is usually ascertainable, a complete defence may be found by reference to the incubation period. For example, if a man claims that he first developed symptoms of typhoid fever twenty-four hours after drinking some water, the water is not to blame, as the incubation period of typhoid fever is seven to fourteen days.

So the consequence of the inoculation of any micro-organism will depend upon these two main factors :

1. The exact kind of micro-organism which has been inoculated, its virulence, numerical strength (dose), powers of multiplication, the purity of infection, method of inoculation, and so forth.

2. The degree of immunity or susceptibility of the patient.

The behaviour of the micro-organisms and their host (the patient) depend upon the degrees present of those two factors. Indeed, the result of the conflict between them is responsible for the ultimate course of the disease.

The treatment will be—(1) Prevention, viz., the killing of micro-organisms by chemicals or heat—antiseptic treatment ; (2) the accentuation of the immunity or resistance of the patient by antitoxine or vaccine injections.

### Consequences of Infection.

In this section we only deal with infection which produces the following :

- (i.) Erysipelas ;
- (ii.) Suppuration, or the formation of matter (pus) ;

- (iii.) Sapræmia ;
  - (iv.) Septicæmia: (a) Acute, (b) Chronic ;
  - (v.) Pyæmia.
- (Puerperal fever, see Sapræmia, etc.)

Where an accident is associated with an infection of a special local kind, the reader must refer to the special articles dealing with the parts involved—Brain, Lungs, Intestines, etc. In another group the infection produces a definite disease, with regular, or more or less regular, symptoms. They are also separately treated, as Anthrax, Glanders, Rabies, Tetanus.

An infection which produces the consequences described in this section—erysipelas, septicæmia, sapræmia, and pyæmia—is caused by the entry of bacteria into the tissues of the body, and practically the same may be said of suppuration. When these diseases occur after an accident causing damage to the human body, two conditions are present which must be clearly distinguished: the first is the simple injury; the second is the infection.

Damage pure and simple, without infection, inflicted upon the body, is followed by a series of local and general events caused by the injury alone. These effects depend upon the individual and the part which is injured, and although they may vary in degree in different cases, yet within limits the results are capable of calculation, and are definite. For example, a blow on the head serious enough to produce injury may be followed by symptoms of concussion, headache, giddiness, etc.; and no matter where the injury be, provided no infection occurs, the injured person will recover, if he can survive the shock of his injury, and if the parts injured be not vital parts.

But no such definite statement can be made with regard to an infected person, for when infection is established, no one can prophesy what will be the consequences. Therefore the events following a simple injury without infection must be kept severely apart in one's mind from the more intricate, and often more dominating, visible and invisible events which arise as the result of an infection.

Finally, it may be impossible to say when an infected person ceases to be infected; for though the obvious signs of infection may have disappeared, yet the micro-organisms which created the past disturbance may still be living at the site of the apparently cured disease, and may be capable of again exhibiting their activity should the resistance of the body become lowered by fatigue, starvation, etc.

Should only one type of micro-organism be found in the wound, the infection is known as a "pure infection"; if one or more, a "mixed infection"; but it must not be inferred that each special kind of bacterium is capable of producing only one particular effect. The more slowly acting micro-organisms, such as those of tuberculosis, are certainly more uniform in their effects upon the body. But the effects created by bacteria capable of rapid action are very variable. Take, for instance, the *Streptococcus pyogenes*: a small dose inoculated into a partially susceptible body may give rise to merely a localized abscess; on the other hand, in a susceptible individual it may produce an attack of erysipelas, and even death, in a few hours from acute septicæmia.

An infective process occurring at the time of the accident or after may be regarded as an accident superimposed upon an accident.

An accident is more likely to be complicated by an infective process when there has occurred a break through the skin, and the instrument which created the injury may supply the dangerous micro-organisms. If the skin be not broken, the subjacent parts in a healthy subject do not as a rule become infected; but in an unhealthy individual, in whose blood bacilli are floating, local infection from the bacteria in the blood may occur at the seat of the injury. (See below, Chronic Pyæmia, p. 449.)

The degree of infection cannot be measured by the size of the wound. For although from its size a large wound is very liable to become infected, yet it may be with only a small dose of a mild, unimportant microbe; but quite a small wound may be the site of an infection which rapidly leads to a fatal termination. For example, extensive wounds caused by burns may heal rapidly with little or no signs of infection, and, on the contrary, fatal cases of erysipelas have been known to start as a result of an insect-bite.

The general and local behaviour of the body towards an infection can be recognized only when the consequences arise, but cannot be foretold with any degree of accuracy. Even when the clinical and bacteriological examination of the parts shows the presence of definite bacteria, it is impossible to foretell with certainty the local and general consequences in the body.

At the time of the accident and for a few hours or more after, it is even impossible to diagnose the presence of infection. The entrance of the micro-organism is not necessarily accompanied

by any pain, swelling, or redness at the moment of the accident, or the wound may not be infected till days or weeks after the injury. The most certain evidence of the infection is the discovery of the micro-organism in the wound or blood by an exhaustive bacteriological examination. (See Diagnosis.)

(i.) **Erysipelas.**—The actual agent of infection is a micro-organism, the *Streptococcus pyogenes*. There are authorities who deny that this is the causal agent, and they describe another streptococcus, which is so similar in character and behaviour to the *Streptococcus pyogenes* that the general consensus of opinion regards it as identical. These micro-organisms gain entrance by a local wound, the site of which may be either large or so small as to be invisible, and they may act in one of two ways discussed below.

(a) *Erysipelas of the Skin (Cutaneous Erysipelās).*—This begins in a few hours, or a day or two, after inoculation, as a red patch at or near the wound or seat of inoculation. It is accompanied by a more or less severe constitutional disturbance, which is initiated by a feeling of chilliness or by a well-marked shivering attack (rigor). The temperature rises rapidly to  $103^{\circ}$  or  $104^{\circ}$ , and remains up with slight remissions for about five or six days, or even longer.

The edge of the inflamed area is abrupt and hard, the surface is shiny, and upon it large blisters (bullæ) may form. Stretching from this red patch may be felt and seen branching and communicating red streaks in the skin. The main inflammation spreads irregularly from day to day until about five or six days, or even longer, when the temperature, redness, and constitutional signs abate; but a peeling surface often remains before the normal colour is finally reached. Erysipelas of the skin is a more serious disease when it affects the face and head, on account of its nearness to the brain.

(b) *Erysipelas of the Parts immediately beneath the Skin (Cellulo-Cutaneous Erysipelās).*—In this condition the subcutaneous tissues, or parts immediately under the skin, are involved. The symptoms, like the other form, begin within a period of a few hours to a day or two of the infection of bacteria. The "subcutaneous" tissue early suppurates—*i.e.*, forms matter—and unless prompt and efficient measures are adopted, the skin covering the parts may die (slough), and be thrown off, leaving large areas with raw surfaces. The constitutional signs are more severe, and more liable to a fatal termination than the cutaneous form.

(ii.) **Suppuration** (the Formation of Matter, Abscess, Carbuncles, Boils, etc.).—This is a term applied to a complicated state of affairs caused by the introduction into the body of an external excitant, usually a micro-organism, which attracts to itself and kills some of the fluid and white corpuscles of the blood, and also destroys the local tissues of the body involved in the process. The symptoms first appear within one to three days after infection. The most obvious result of this process is the collection in the centre of the infected spot of a thick, whitish-yellow fluid, which is called “pus” or “matter.” This pus or matter is the outward and visible sign of suppuration.

When suppuration is at its height in seven to fourteen days, it is regarded as “acute suppuration.” Should it take from one to two months to mature, it is described as a “chronic suppuration.” A “subacute suppuration” occupies an intermediate time to develop, and consequently there are acute, subacute, or chronic abscesses. Boils and carbuncles are practically acute abscesses.

Suppuration occurs as the result of the introduction into the living tissues of an external excitant, which may be living or lifeless. It is necessary to first refer to the lifeless excitants, but the reader must know that it is only the living excitants of suppuration with which he will have to deal in ordinary accident cases. Suppuration, or something very like suppuration, can be induced by means of a lifeless agent, but only after careful and elaborate preliminary precautions, which must be of so precise a character that they render the process practically impossible in ordinary accidents.

As a matter of academical interest, then, the following are prominent among the lifeless causal agents of suppuration: Dead micro-organisms, products of micro-organisms (toxines, etc.), croton-oil, pyrogallic acid, cantharides, carbolic acid, turpentine.

The living causes of suppuration are, of course, micro-organisms. But it must be realized that all micro-organisms are not capable of inducing suppuration, and even those which do possess that capacity do not invariably produce that result when they are inoculated. Among the micro-organisms which cause suppuration are the following: *Staphylococci*, *streptococci*, *Diplococcus pneumoniae*, *Micrococcus gonorrhoea*, and the following bacteria: *Coli communis*, *Pyocyaneus*, *Mallei* (glanders), *Typhi* (typhoid), *Pestis* (plague), *Tuberculosis* (tubercle). Of entranebe most common causes of suppuration are the staphy-



lococci and streptococci, in pure or mixed infections. Except in the peritoneal cavity, it is comparatively rare to find a pure infection of streptococci in matter (pus), and in the writer's opinion, when it is found, it generally appears in the deeper tissues, as the lymphatic vessels and glands, and sometimes in bursæ after an attack of erysipelas. Boils and carbuncles are usually due to the presence of staphylococci.

The above micro-organisms can induce acute, subacute, and chronic suppuration, except *Bacillus tuberculosis*, which can produce only chronic suppuration. In fact, chronic suppuration and tuberculous suppuration are regarded by some surgeons as being practically the same thing, and this, too, in spite of the fact that tuberculous suppuration is rather a degeneration than a process of true suppuration. Tuberculosis is a very common cause of chronic suppuration, but it ought not to be regarded as the only cause, because other micro-organisms—*e.g.*, staphylococci—have been found in pure cultures in many chronic suppurations in bone; also a slow-forming suppuration may be induced by *Oospora bovis* (actinomycosis).

Other micro-organisms than those mentioned above have been found in pus, but there is no absolute proof that they are the cause of suppuration.

Suppuration is a much more complicated process than appears from what has been stated, and from what earlier surgeons considered it to be.

Experiments by the writer demonstrate that, ten minutes after inoculation of animals with staphylococci, the internal organs, the liver, and sometimes the spleen, as well as the site of inoculation, revealed the bacteria inoculated; whereas in other animals, which were allowed to live ten days, no bacteria were found in the liver and spleen, showing that these animals had resisted and overcome the infection. The animals that lived went through a critical phase, in which life and death hung in the balance, for the micro-organisms in the liver or spleen might have caused a fatal result had there been greater susceptibility, or had the micro-organism gained admission into the blood-stream in greater numbers or in a higher degree of virulence.

When a person develops an abscess, he has passed through this critical period of a general infection, out of which he has safely emerged; but whilst the infection was in progress his existence was imperilled, until he had overcome the bacteria internally, and had become to some extent protected against

them. Although this was not sufficient to conquer the local forces arrayed against him at the seat of inoculation, where an abscess finally appears.

From this it is clear that the formation of matter, or suppuration, in the body is due to an infective process, the resistance to which and final establishment of immunity is the fundamental part of the patient's recovery.

Suppuration may occur in any of the natural cavities of the body. It may also occur in unnatural cavities made by the micro-organisms—*e.g.*, in abscess. A boil is an abscess which began by an infection in the sheath of the hair and spread to the surrounding parts. A carbuncle is a collection of confluent boils.

It is necessary to remind the reader once more that suppuration is not necessarily bound to follow the inoculation of a micro-organism which can induce suppuration.

(iii.) **Sapræmia.**—This occurs in two forms, the symptoms of either of which may appear within a few hours after infection of a wound.

(a) "Septic intoxication" is due to the absorption of the poisons (toxines) produced by bacteria which are capable of living only on the dead tissues in a wound. These bacteria must be contrasted with those of the next class (traumatic fever), which grow on living tissue in the wound, and with those of septicæmia, in which the micro-organisms themselves are absorbed into the blood. Pure septic intoxication is the least serious of all the infections, for as soon as the dead tissue is removed the poison ceases to be produced by the bacilli, and thus the infected person at once begins to recover. It is more intense, consequently, when these micro-organisms gain entrance into lacerated and contused wounds, where there is comparatively a large amount of killed tissue.

(*Puerperal Fever.*)—Septic intoxication of this nature occurs in that form of puerperal fever which is caused solely by the poison produced by micro-organisms in the womb acting on and causing decomposition of such dead material as blood-clot or a fragment of retained after-birth (placenta).

Another form is the traumatic fever next described.

(b) Traumatic fever is due to the absorption of toxines produced by micro-organisms which grow on living and dead tissues in the wound, but they remain fixed only in the wound, and are not absorbed to any serious degree into the general circulation.

In a few hours after such infection the temperature rises from  $103^{\circ}$  to  $104^{\circ}$ , and gradually subsides about a degree daily, until the normal is reached in three or four days, and does not rise again. The wound almost invariably suppurates, but the patient usually recovers completely, but in severe cases the disease may pass into acute or chronic septicæmia or pyæmia.

(iv.) **Septicæmia** : (a) **Acute**, (b) **Chronic**.—(a) **Acute Septicæmia** is frequently a sequence of one of the two forms of sapræmia described above, but it may commence a few hours after an injury. It is a disease not perfectly understood, but in animals it is a more definite and specific condition than in man.

In animals the micro-organisms are not only found in the living tissues of the wound, but also in numberless quantities in the circulating blood and internal organs, where they multiply and produce their poisons (toxines).

In man as in animals, the micro-organisms exist in the living tissues of the wound, but their presence in the general circulation is by no means so marked a feature as in animals. The difference of septicæmia and sapræmia in man, as has been said, is that micro-organisms gain admission into the general circulation in septicæmia, but remain in the wound in sapræmia. In septicæmia the particular micro-organism varies, and the disease most frequently follows the traumatic fever just described. The patient is very ill, and shows all the signs of profound constitutional depression due to the absorption of the poisonous products of the micro-organisms. The tongue is dry and brown. The pulse is quick, and later on the beats are intermittent and hardly perceptible. There is a rapid emaciation, and often vomiting and diarrhœa. This state may exist for many weeks, or death may occur in five or six days. Spots of bleeding (hæmorrhage) appearing under the skin and delirium usher the fatal termination (puerperal fever). In the more serious and frequently fatal form of puerperal fever, the type of infection is usually a septicæmia of this kind.

(b) **Chronic Septicæmia, or Hectic Fever**.—This more nearly resembles sapræmia than the acute form of septicæmia; that is, the products of the micro-organisms are chiefly absorbed from the wound, for the micro-organisms do not gain admission within the general system.

The temperature is characteristic in hectic fever; it rises to  $103^{\circ}$  or  $104^{\circ}$  at night, and falls to or below normal in the morning; otherwise the constitutional signs resemble in milder degrees those of septicæmia.

(v.) **Pyæmia.**—This is probably the most serious of all wound complications. The disease is caused by the bacteria which produce matter, or pus—"pyogenic micro-organisms." It begins seven to fourteen days after infection. Its onset is marked by a rigor, or shivering attack, which lasts about half an hour, during which the temperature rises to  $104^{\circ}$  or more. The fall of temperature is rapid, and is accompanied by profuse sweating, till it reaches normal, where it remains sometimes for twenty-four hours, or even longer, when another rigor begins and the patient goes through exactly the same phase. When the patient is getting worse instead of better, the rigors recur with shorter intervals.

For the classical signs of pyæmia to become manifest, the infecting micro-organisms must gain access into the general circulation, and must do so in the following way: The infecting bacteria in the course of their invasion attack a vein; the inflammation which ensues in the vein (phlebitis) results in the formation of blood-clot (thrombus). The thrombus is broken up by the action of the micro-organism, and a part of it (an embolus) is then carried by the blood into any part of the body where it is stopped, and produces secondary abscesses. Fresh abscesses may develop in the lungs, liver, musculature of the heart, and in joints, various cavities (pleural, pericardial, etc.).

As these portions of clot carry with them some of the micro-organisms, fresh abscesses develop at the sites of their arrest. In addition bacteria escape free in the blood, and may even be so numerous as to form a compact collection solid enough to plug the smaller bloodvessels of the lungs, liver, etc., where they also set up an abscess.

The process is as follows: The infected clot (thrombus) breaks up in the vein, and the current of blood first carries fragments (emboli) to the right side of the heart, by which they are then pumped into the lungs. It is possible to imagine that, if the bacteria or the fragments of clot be sufficiently small, many of them may pass through the smallest bloodvessels of the lungs (the capillaries), are then carried to the left side of the heart, and are pumped through the arteries all over the body. If, on the other hand, the fragments are too large, they will be caught in the lungs, will block up a bloodvessel and form infected clot (thrombus). This condition is typical of the disease. [Fig. 110.]

*Portal Pyæmia.*—The blood from most of the abdominal organs is not carried directly to the heart, but is poured into the branches

of the vein which empties into the liver. This vein is called the "Portal Vein," and should an infected clot form in a vein of the portal system, and break up and be carried in the bloodstream, the first place in which the fragments will be caught will not be the lungs, but the liver. Abscesses then form in the liver, and may infect the blood flowing from the liver to the heart, repeating the process described above. This infection is known as "portal pyæmia."

*Chronic Pyæmia.*—There is a condition known as "chronic pyæmia," in which the disease is not associated with the separated portions of clot in an infected vein, which is the essential etiological factor in true pyæmia. Chronic pyæmia is probably due to micro-organisms which, having gained access to the blood, are deposited on some susceptible spots within the body, and there set up abscesses.

### Disease.

1. **Caused by the Infection.**—(i.) **Lardaceous or Amyloid Disease.**—This disease is a common sequence of prolonged suppuration and hectic fever; its exact nature is unknown. Rare cases have occurred in which suppuration has not been observed. In the typical disease the muscle coats of the smaller arteries of the spleen and liver are first affected with a waxy substance, from which "lardacein" can be obtained. The kidneys and small intestines become seats of the disease soon after the spleen and liver. As the disease progresses the spleen, liver, and kidneys are much enlarged. When suppuration ceases the disease disappears. Although the disease becomes grossly evident somewhat late in the process of suppuration, yet authorities have demonstrated "lardacein" in white blood-corpuscles, leucocytes, and even in the muscular coats of the bloodvessels, eleven days after the suppuration had begun.

(ii.) **Blood-Changes.**—Although, strictly speaking, these are part of the consequences of the infective process, yet for convenience they are mentioned here. They are anæmia and the formation of antibodies, etc.

(iii.) **Ulceration of the Cornea.**—Erysipelas of the face, like other infections, may lead to inflammation of the conjunctiva, which is followed by ulceration of the cornea. (See Eye, p. 317.)

(iv.) **Ankylosis and Adhesions of Joints.**—After any infection by which its lining tissues are destroyed, the whole interior of the joint becomes matted together by fibrous bands (fibrous

ankylosis), or even bone (bony ankylosis). This may arise after any infection, especially pyæmia, or as a result of an abscess of bone bursting into a joint.

2. **Existing before the Infection and aggravating its Effects.**—A low state of health is a particular feature in the causes of the more virulent consequences of infection. A large severe injury, fatigue, starvation, or nervous anxiety, are features in the production of severe effects of infection.

Diabetes, chronic alcoholism, kidney disease, would be dangerous in association with processes of infection, even when they occur singly. When more than one co-exist with infection, the danger of the process is great.

### Operation.

The operative treatment of the infective conditions described under this section is divided into two main classes, which may be used separately or in combination, the main objects of both treatments being to aid the patient to establish immunity. The first consists in inoculation of either antitoxine or killed bacilli (vaccine). The second is of a more violent, surgical nature, and consists in incisions, drainage, scraping, the application of antiseptics, and even amputation.

**Inoculations.**—As has already been mentioned under the head of "The Nature of Infection" above, the body has a great resisting power to the bacteria of infection, which have to keep up a constant struggle to maintain their existence in the human body. Among the resisting substances which are specially produced by the body are those directed against the products of the bacilli (toxines), and are hence known as "antitoxines."

(i.) **Antitoxine Injections.**—Antitoxines are prepared from infected living animals, in which they are found in the fluid part of the blood. The animal is first poisoned to some degree with the diphtheria or other toxines made from bacteria, and in its attempt to resist the toxines large quantities of antitoxines are developed in its blood, and in consequence the blood of the animal can be used as a source of antitoxine. Many diseases are treated by antitoxine injection, and among this group are found diphtheria and tetanus, which are perhaps the most amenable to antitoxine treatment. This blood-containing antitoxine can thus be used as an injection to neutralize the toxines of human beings suffering from an infection of the same bacteria.

Antitoxines have been prepared and extensively used for infections caused by streptococci, staphylococci, and gonococci,

but after a wide experience they are, in our opinion, so far of very little value.

(ii.) **Vaccination.**—This is of two kinds: one which resembles the vaccination against smallpox, and is an inoculation of materials derived from outside the body, which, as Dr. Hort suggests, may well be called “hetero-inoculation,” in opposition to the other form, “auto-inoculation,” where the inoculation is made with materials developed in the body.

(a) *Hetero-Inoculation.*—The injection is made of dead organisms of the same kind as those vaccines producing the disease from which the person is suffering. These, in some way not completely understood, but allied to the method by which a person resists infection, help the body to resist the live micro-organisms which are causing the disease in the sick person.

(b) *Auto-Inoculation (Auto-Vaccination).*—This consists in disseminating about the body larger doses of the poisons of the bacilli which are producing disease in one spot than were circulating before the auto-inoculation was performed. For example, in the case of a man suffering from infection of the knee-joint, gentle massage and movements of the knee are performed. These movements cause a larger dose of poison-toxines, etc., produced in the knee, to enter the circulation of the patient, and hence the rest of the body is stimulated to produce antitoxines.

The other operations that may be required are as follows. Although they may be necessary in critical conditions, they are none of them dangerous.

(i.) **Erysipelas.**—(a) *The Cutaneous Form (Erysipelas of the Skin).*—Although there is a variety of treatment, it usually requires no operation other than the hetero-vaccination as above described.

Antiseptics of various kinds and strength have been injected into the healthy tissues just beyond the margin of the disease in erysipelas.

(b) *The Cellulo-Cutaneous Form (or Erysipelas of the Tissues under the Skin).*—Early incisions are usually required to relieve the tension of the swelled skin by letting out the matter (pus) formed underneath.

Bare areas, from which skin has been thrown off after destruction, may require skin-grafting.

(ii.) **Suppuration.**—Any collection of matter should be let out as soon as diagnosed, and if necessary the cavity must be drained.

(iii.) **Sapræmia.**—(a) *Septic Intoxication.*—As this condition

is caused by the action of micro-organisms on the dead tissues in the wound, it is obvious that the removal of the dead tissue is of the utmost importance. The wound must be thoroughly cleaned, and in the case of such places as the womb will require complete and thorough removal of all contents in a septic condition, such as blood-clot or retained after-birth.

(b) *Traumatic Fever*.—The only operation that is usually required is efficient drainage.

(iv.) **Septicæmia**.—The removal of the source supply of micro-organisms from the seat of inoculation by the insertion of a drainage-tube if required, and complete cleaning of the wound with antiseptics; hetero-vaccination.

(v.) **Pyæmia**.—Accessible collections of matter in joints, muscles, and skin should be evacuated as soon as possible. Hetero-vaccination may be practised.

### Cure.

In the infective processes, the young person recovers sooner than the old, the well-fed sooner than the starved, and the person free from other constitutional disturbances sooner than the person in whom the infection is complicated by some associated malady.

(i.) **Erysipelas**.—(a) *Cutaneous*.—This usually runs a definite course, and is generally well in about fourteen days; but it may go on spreading to new areas, leaving cured parts behind, and so may persist for some long time.

(b) *Cellulo-Cutaneous (Subcutaneous)*.—The length of convalescence is regulated mainly by the number, length, and depth of the incisions which have been necessary to liberate the pus (or matter) beneath the skin, and upon the size of the area which suppurated, and by the degree of virulence of the toxine.

(ii.) **Suppuration**.—Very soon after the matter (pus) has escaped, the abscess rapidly heals and the person soon recovers, unless health is otherwise lowered by pre-existing disease, which will delay, or even prevent, recovery.

(iii.) **Sapremia**.—(a) *Septic Intoxication*.—The removal of the dead tissue acts like a charm. The production of the poison instantly ceases, and recovery is rapid and uncomplicated.

(b) *Traumatic Fever*.—The duration of the fever is usually about three days, but as the wound almost invariably suppurates, the length of time for cure depends on the seat and size of the wound.



(iv.) **Septicæmia.**—Prolonged convalescence and slow recovery are the characteristics of this malady.

(v.) **Pyæmia.**—This is often fatal or extremely slow in recovery. Joints in which matter has formed may never recover their function.

**Joints (Ankylosis).**—The cure to be obtained by the breaking down of adhesions in an ankylosed joint is always slow, and may be incomplete.

#### Return to Work.

In all these diseases, the more serious the infection, the slower will be the cure and the longer will be the convalescence required after surgical cure.

**Joints (Fibrous Adhesions and Bony Ankylosis).**—The fixity of a joint may permanently incapacitate the workman from following his employment.

#### Recurrence.

After recovery from an infection, the substances developed in the system, either naturally or acquired, usually protect an individual for a period which varies in different diseases. In erysipelas this protection lasts three to six weeks, in typhoid fever it lasts for years. In any one of the infections dealt with in this article it may be very difficult to say when the micro-organism has been eradicated from the system.

#### Diagnosis (the Actual Demonstration of the Micro-Organism of Invasion).

To be certain that a particular micro-organism found in the wound is the actual agent causing the disease, it is essential that the following conditions are present: That it should be found in the wound or the discharges; that its behaviour when grown artificially in the bacteriological laboratory should be characteristic; that when this growth is inoculated in lower animals it should reproduce the same disease; and, finally, that the same bacilli should again be found in the tissues or discharges from those animals.

The "agglutination test" and "opsonic index" are scientific means of discovering the presence of precise micro-organisms which have caused the particular diseased condition. (See Ptomaine-Poisoning, p. 660.)

In other respects there is nothing special to remark about

the diagnosis, which should not be difficult to a medical practitioner.

This elaborate demonstration of the micro-organism places the actual agent of disease beyond doubt. But there are also other clinical signs of great value which indicate the presence of an infective process of some kind. In many cases a clinical examination is the only evidence available, yet this clinical evidence alone may indicate the precise micro-organism which is inducing the local and constitutional disturbance, such as the clinical evidence or symptoms caused by the *Bacillus tetani* and rabies; and although the symptoms of pneumonia, tuberculosis, typhoid fever, and other diseases, are not quite proof of the presence of the particular micro-organisms, yet they are so indicative as to be almost infallible.

### Malingering.

Malingers often induce sores, and sometimes realize the importance of the rise of temperature in cases of infection, and they have been known to insert the thermometer in a cup of hot water or tea, and even squeeze the bulb of the instrument, to raise the mercury.

### Criminal and Self-inflicted Wounds.

The artificial production of sores by caustics, etc., is a common trick of the malingerer or the hysterical girl or man, and the same types of person may keep a wound open by constantly irritating it in some way. These wounds rapidly heal when protected. Wounds which have been made for the specific purpose of inducing infection are practically unknown; the knowledge and opportunity for creating such a state of affairs is probably too technical. Where infection does complicate a criminal or self-inflicted wound, it is an "accidental" addition to the injury; and as regards the responsibility of another who caused the wound, it is held to be part of the "accident" or "criminal wound" as the case may be.

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*For legal cases of Infection (Erysipelas, etc.) see CASE GUIDE:  
Infection.*

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## INFLAMMATION.

*See* INFECTION.

# INSANITY CAUSED BY INJURY.

By THEO. B. HYSLOP,

M.D., C.M., M.R.C.P. (EDIN.), F.R.S. (EDIN.),

Late Resident Physician, Bethlem Royal Hospital ; Lecturer on Mental Diseases and Mental Physiology, St. Mary's Hospital School ; Lecturer on Mental Disease, London School of Medicine ; Examiner, Royal Army Medical Service.

## Head-note.

IN all cases of insanity caused by accident, the severity of the symptoms is apt to develop in proportion to the predisposing tendency of the individual.

## Technical Terms.

(For other technical terms, see Brain.)

*Āmnēsīa*.—Loss of memory.

*Ārāchnoid*.—See Meninges.

*Central Nervous System*.—The brain and spinal cord.

*Dūrā Māter*.—See Meninges.

*Ēvīchsēn's Disease*.—Traumatic neurasthenia.

*General Paralysis of the Insane*.—A disease of a progressive nature, predisposed to by syphilis and its treatment, and in which paralysis and insanity are both present to some greater or less degree.

*Hallucination*.—A sensation perceived by the mind, whether through the sense of sight, hearing, smell, taste, or feeling, without any external cause capable of producing it.

*Hemispheres*.—The two halves of the large brain are called "hemispheres." [Fig. 40.]

*Illusion*.—A false interpretation of a sensation actually perceived.

*Mēnīngēs*.—The coverings of the brain, of which there are three : The dura mater, a thick, tough membrane which lies immediately inside the skull, to which it is partially attached ; the arachnoid, a thin membrane lying between the dura mater and the pia mater ; the pia mater, a thin membrane which lies closely attached to the surface of the brain. [Fig. 52.]

*Mēnīngītīs*.—Inflammation of the coverings of the brain (the meninges). Pachymeningitis is inflammation of the dura mater.

*Neurōsis*.—A disturbance of the nervous system caused by injury or disease, and producing either subjective, intellectual or objective symptoms.

*Pāchymēningītis*.—See Meningitis.

*Pārasyphilitic*.—Conditions occurring as sequels to syphilis, but which cannot be proved to be due to syphilis.

*Pāvāmnēśia*.—Perverted memory.

*Pīā Māter*.—See Meninges.

*Puerperal Insanity*.—A form of insanity which occurs in women within a few weeks after the delivery of a child.

*Suppuration*.—The formation of matter (pus).

*Trauma*.—Injury.

*Traumātic*.—Caused by injury.

*Vēntricles (of the Brain)*.—Spaces in the substance of the brain containing fluid. [Figs. 47, 48.]

### Anatomy.

See Brain.

### Consequences of Accident.

The subject of nerve disturbance, or "neurosis," following injuries has been the cause of much discussion in the past. The various morbid conditions following injuries were called "spinal concussion," "railway spine," "traumatic neurosis," "Erichsen's disease," etc., and no attempt was made to differentiate between the hysterical and neurasthenic features of the cases. Nowadays it is recognized that after injuries (trauma) or shocks four classes of conditions may arise, viz. :

- (i.) Actual structural or organic changes in the central nervous system.
- (ii.) Traumatic hysteria which is the consequence of injury.
- (iii.) Traumatic neurasthenia.
- (iv.) Traumatic psychoses, or morbid mental states.

The writer has seen in Bethlem Hospital almost every variety of mental degeneration as the result of injury to the nervous system.

It is almost impossible to be certain in many cases whether or not actual structural damage has been done to the central nervous system. In all of the last three conditions mentioned above there may or may not be structural injury to the brain, for they can each be produced in consequence of injury to the body which does not cause any actual structural or

organic change in the central nervous system. So that although a simpler division may be made of two classes—(1) where actual structural damage has been produced, and (2) where no such damage is discoverable—yet the symptoms which occur in the second case, and which are purely mental, are indistinguishable from those where evidence appears that actual damage has occurred. In a great many cases the presence of actual structural damage is clearly indicated by loss of sensation, paralysis, etc., as described under the section on Injuries to the Brain, and so we will first deal with Section i., remembering all the time that much or all of what is described below can occur without any proof of injury to the brain.

1. **Actual Structural or Organic Changes in the Central Nervous System.**—In dealing with a case in which physical or mental symptoms follow on injury, it is of course essential to recognize the possibility of the existence of fracture of the skull, or of fractures or dislocations of the bones of the spinal column, or of rupture of the muscles or ligaments which are connected with the spine or skull. Inflammation or hæmorrhage into the brain or spinal cord, or their coverings, must also be carefully considered.

The symptoms and consequences of injury to the brain and spinal cord (other than insanity) are dealt with elsewhere under Brain and Spinal Cord.

In addition to direct obvious consequences of injury to part of the brain or spinal cord, epilepsy, disturbances of the nervous equilibrium, neurasthenia, and hysteria, may also be the result of mechanical injury. Sometimes the evidences of local injury are very slight, or even absent, but it must be remembered that mere concussion may induce bleeding on the surface of the brain or in the nervous substance.

Mental disease may be brought about by a definite injury to the brain substance, or by a mere jar or shock, causing commotion or propulsion of the brain or spinal fluid, and resulting in alterations in the functions of the brain and spinal systems. Or it may happen that the shock is followed later by various neurotic conditions (psychoneuroses), such as neurasthenia or hysteria, or there may be started some degree of acute or chronic degenerative process in the brain or other parts of the nervous system.

It is sometimes difficult to determine whether the symptoms are merely functional, or indicative of some fine structural damage.

(a) **Loss of Memory.**—The immediate consequences of injury or shock are in part referred to under Brain; but after an injury or shock, loss of memory (amnesia) is often a marked symptom, which may begin immediately and continue for a longer or shorter period. It may extend backwards, and include recent or remote events in the past. According to Ribot, it more commonly extends both backwards and forwards, and there may or may not be recovery from the loss. Sometimes re-education takes place, and “new memory” is acquired. It is assumed that either the registration of events immediately anterior to the shock is interfered with or effaced, or, if persisting, their power of revivification by association with the present is destroyed. Numerous instances are recorded in which, through injury or shock, the immediate antecedent events have been entirely effaced from memory. A blow on the head, a fall, a fever, or an acute illness, may produce a like effect.

(b) **Organic Dementia (Insanity).**—Under the head of organic dementia, or insanity caused by structural damage to the brain, is included a large number of conditions. In it we find all the group of cases which may arise from fractures or depressions of the skull in various regions, from inflammation of the coverings of the brain, or from pressure upon, and affections of, any part of the brain surface (cortex), from bleeding under the coverings of the brain (subdural, subarachnoid or pial hæmorrhage), from any of the numerous structural damages to the coverings or brain centres, or from the subtle nutritive (or granular) changes in any or all parts of the finer textures of the brain and its working apparatus. With such a diversity of possible lesions, it is not to be wondered at that the physical and mental symptoms may be as numerous as the phenomena of the individuality.

(c) **Delusional Insanity.**—Another group of cases contains those who, through injury to the brain, gradually develop delusions which ultimately become systematized and incurable. At first there may be hallucinations or illusions of a chronic type. In the earlier stages the patients are irritable and impulsive, and they attempt suicide or homicide, or they may have convulsive seizures. Sooner or later the emotional outbursts give way to a more chronic condition of suspicion, with occasional outbursts of violence. The end is usually dementia and death. Sometimes the persecutory delusions lead to brutality and gross outrages. Not infrequently there is a periodic insomnia, headache, vertigo, and local paresis.

(d) **Traumatic Hysteria and Traumatic Neurasthenia.**—Yet another group comprises the conditions of traumatic neurasthenia and traumatic hysteria. Various disturbed nerve conditions (morbid psychoses) become established. There is often some degree of depression (hypochondriasis), with loss of affection and interest in others, with feelings of impending danger, emotional instability, irascibility, confusion, loss of energy, insomnia, loss of memory, and many varieties of sensory motor, vasomotor, and trophic symptoms. Physically they suffer from functional or “psychical” paralysis.

(e) **Traumatic Epileptic Insanity.**—Traumatic epilepsy is not an uncommon sequel to injury to the head. Sometimes distinct pathological changes are to be found, and the nature of the lesion will determine the kind of epilepsy and its duration. As a consequence of the epilepsy insanity may supervene. In these cases the equilibrium of the nervous system seems to be profoundly disturbed, so that very slight causes are sufficient to induce the convulsions. It is important to remember that, in individuals suffering from traumatic epilepsy, an irritable explosion may be induced not only very readily, but it may be of extreme violence, and lead to acts which render them irresponsible criminals.

(f) **Insanity caused by Operation** (see Operation).—Insanity occurring as the result of an operation is in its character often unduly severe and intractable, and the severity of the mental symptoms is often quite out of proportion to the importance of the operation. Thus, a minor operation may be followed by incurable insanity. In such instances the operation merely brings out the latent tendency to insanity, and from the commencement of the insanity actual structural degenerative changes may occur.

2. **Insanity caused by Accident where there is no Actual Structural Damage in the Brain or Spinal Cord.**—As has been said already, each of the above conditions produced when structural damage is discoverable can also occur after an accident where no structural damage is discoverable, with the exception, perhaps, of epilepsy. A violent shock to the system with or without injury to other parts of the body than the brain or spinal cord can produce insanity, and, in addition to those already described, the following must be referred to here.

(a) **Emotional Injury or Emotional Traumatism.**—The so-called “emotional traumatism” includes all the moral shocks which may disturb the functional equilibrium of the brain.

Severe emotional shocks may so derange nutrition and the anatomical or molecular integrity of the brain as to lead to maniacal or convulsive paroxysms, or they may cause paralysis of thought and action, leading to dementia, and even death.

(b) **Hysteria.**—Reference has already been made to the neurasthenic and hysterical types of traumatic injuries, but little or no account has been taken of the relationships existing between neurasthenia, hysteria, and malingering. Accidental injuries may be followed by minor forms of alteration of personality, marked epilepsy, mental automatism, or double consciousness. In these conditions consciousness is incomplete or partial, and the individual retains little or no consciousness of having performed various acts. In some instances, however, the attacks assume the proportions of epileptiform, or even apoplectiform, seizures. (For Malingering, see below.)

(c) **Insanity arising after Operation.**—See Operation.

### Disease.

1. **Caused by the Accident.**—The secondary effects of injury or shock are very numerous and widespread. In addition to the acute or chronic inflammation of the brain, exudation of fluid, suppuration, softening, and even tumour, arising out of injury, there may be a slow nutritive alteration of the brain, which sooner or later leads to mental disorders. It is not uncommon for nervous and mental abnormalities to follow immediately upon a brain injury, then to disappear either entirely or leaving some slight warp or progressive emotional instability, irrelevance of thought, or capriciousness of conduct; but more commonly, where the balance of nutrition is interfered with, there is apt to be some progressive organic change, which acts disastrously so far as the mind is concerned. (For General Paralysis of the Insane, see below.)

2. **Existing before the Accident and aggravating its Effects.**—(i.) **Predisposition** (see below, Age Incidence of Insanity).—The predisposing tendency is of great importance in the consideration of every form of neurosis following injury or shock. In those individuals who are predisposed to nervous or mental disease through heredity, their nervous systems are apt to show evidences of instability when afflicted by very slight causes. Thus, the children of degenerate parents are not only apt to be excitable, emotional, impulsive, and to suffer from epilepsy, hysteria, and allied disorders, but the grosser



neuroses and mental perversions latent in their organizations may be precipitated, as it were, by causes so slight as to be apparently out of all proportion to the results. Thus, for instance, it is common to meet with chronic and incurable forms of fits (convulsive neuroses), and even insanities induced by such slight causes as the extraction of a tooth, the administration of an anæsthetic, a shock or fright, and by suggestion.

(ii.) **Suggestion.**—The condition of suggestion is much more frequent than is generally recognized. Sometimes the mental aspect of the individual is one of expectancy or preparedness, and this alone renders him more liable to the inception of the malady which is anticipated. Thus, the knowledge possessed by an individual that his ancestors were prone to suffer from certain mental abnormalities, or that they committed suicide, homicide, or other acts with serious moral and legal bearings, leads that individual to bear in his mind the possibility of a similar malady or catastrophe occurring to himself. This mental factor of expectancy is also seen in such instances as after child-birth (in the puerperal state), where the occurrence of a former attack of puerperal insanity suggests another after the birth of her next child.

The influence of the mind upon the body is so great, and the conditions induced by auto-suggestion and expectancy are so numerous, that it is impossible to deal adequately with the subject here.

(iii.) **Alcohol.**—Another point of interest is to be seen in individuals of alcoholic habits, who, without having been inebriated, have rendered their brains markedly susceptible to the ill-effects of shock. The writer has seen many instances of alcoholic delirium, delirium tremens, and actual insanity, precipitated in such cases by injuries or shocks of so slight a nature that in the normal individual they would have been followed by little or no effect. In alcoholics the condition of perverted memory (paramnesia) is generally very prominent, and a slight shock may be sufficient to determine its existence. In such cases the memory of the event or shock may be much perverted, and the experiences narrated by the patient are not infrequently pure fictions of the imagination. (See Diagnosis, Malingering.)

(iv.) **Syphilis.**—Syphilis and its treatment by mercury may render the brain less plastic and less capable of responding to altered conditions of its blood-supply. Thus, to a person who has been affected by syphilis and its treatment, an accident or

injury to the brain is apt to prove more severe than to one who has not had syphilis. Moreover, a brain injury to one thus predisposed by syphilis may determine the onset of general paralysis of the insane.

Alcoholic and syphilitic persons are not the only ones who are prone to suffer from effects far in excess of actual causes. Neurotic subjects of the insane diathesis, or who are degenerates on account of the existence of other forms of disease, or who are exhausted by overwork, anxiety, insomnia, privation, and sexual excess, all are prone to suffer in an exaggerated way from the effects of even slight injuries.

(v.) **General Paralysis of the Insane.**—In general paralysis of the insane injuries to the brain are sometimes assigned as the causes.

It appears correct to consider general paralysis of the insane as being a sequel to syphilitic infection and its treatment, whereby the brain tissues become less elastic, and therefore less capable of reaction to undue stress or strain. In a brain which has thus been rendered less adaptable to increased blood-pressure, it is not to be wondered at that, when the balance of nutrition has been disturbed by some injury or shock, there should be failure in eliminating the waste products, and therefore accumulation of what becomes a suitable food for the growth of bacteria and all the agents which bring about a terminal infection or progressive paralysis. Certain it is that, in a person predisposed to nervous weakness by syphilis, an injury or shock is apt to precipitate the progressive degeneration of general paralysis, which ends fatally within a year or two. Those cases in which injury has caused local destruction of part of a cerebral hemisphere with secondary wasting, or with implication of the cranial nerves at the base of the brain, or with secondary descending systematic spinal degeneration, are, in the writer's opinion, not cases of general paralysis, even though they terminate fatally. The mental and physical symptoms of so-called "traumatic general paralysis" are so numerous, and so many widely varied conditions are included under the term, that it would appear best to term all those conditions which are not parasymphilitic simply "traumatic neuroses of various types," confining the term "traumatic general paralysis" to the types which are primarily syphilitic and secondarily due to traumatism, and possibly terminal bacterial infection.

### Insanity caused by Accident at Various Ages of Life.

The consideration of the traumatic factor at the different stages of life is of interest, and it would appear advisable to refer to some main points in connection therewith.

(i.) **During Pregnancy.**—It is well known that severe physical shocks to the pregnant mother have affected the nervous and mental development of the child.

(ii.) **During Labour.**—At birth all sorts of ill-results may happen through accident or injury.

(iii.) **Infancy and Childhood.**—In infancy and childhood injury to the skull and brain is apt to lead to idiocy, imbecility, convulsions, St. Vitus's dance (chorea), hemiplegia (paralysis of one side), contractures, arrested development, and mental disturbances of an impulsive and epileptoid character. Such children usually become demented and die at a comparatively early age. Sometimes convulsions are very prominent and persistent, and with the progressive wasting of the brain they exhibit progressive deterioration of the mental and physical faculties.

Traumatic idiocy must vary with the amount of destruction of the nervous tissue, but in some cases a trifling injury causes grave disorders, whereas in others what appears to be a serious injury is attended by slight results. There is no doubt that there are many instances of idiocy attributable to injury to the head in infancy, but it must be remembered that parents are often extremely ready to attribute the idiocy of their children to an accidental fall or blow.

It is of interest to note that in some instances an injury to the head may be productive of good results. The writer has seen a case in which a weak-minded youth had a fracture of his skull, with some loss of brain substance and subsequent marked improvement in mental calibre.

Pritchard records the instance of a family consisting of three boys who were all considered idiots. One of them received a severe injury to the head; from that time his faculties began to brighten, and he subsequently became a man of good talent, and practised as a barrister. His brothers remained idiotic.

Haller also has reported the case of an idiot whom a wound in the head restored to understanding.

(iv.) **Youth.**—In youth an accident or injury to the brain, when followed by mental disturbance, is almost invariably of

the impulsive type. Slight attacks of maniacal excitement, with mischievous, violent, and destructive tendencies, either recurrent or continuous, are common; or there may be moral perversions with impulsive tendencies to violence.

Sometimes acute or protracted maniacal excitement, recurring at intervals of weeks or months, follows head injuries in children. The various forms of mental disturbance said to be due to the nerves in children are almost invariably merely the psychical equivalent of a reflex epilepsy. Equirol is of opinion that insanity in children after an injury ensues sometimes after an interval of several years. This writer mentions the case of a child who fell on his head when three years of age; he complained from that time of pains in his head; about the time of puberty these pains increased, and at seventeen years he became maniacal.

### Operation.

(a) **Operations for Cure of the Consequences of Accident to the Head**, where definite organic damage has been produced to either the bone coverings or substance of the brain or spinal cord, are fully discussed under the head of Brain and Spine.

(b) **Operations for the Cure of Insanity**.—Whether this insanity is caused by accident or not, operations have been recommended and attempted for various forms of insanity, especially where, as in epilepsy, there is some localizing feature which might indicate irritation of a particular part of the brain; but these cases would probably be included under cases of gross organic injury. For general insanity there are a few curious recorded cases that might justify a surgeon who advocated an operation. Some of these are mentioned above under the heading of the insanities of the various ages of life. The following is, however, an interesting case. Van Swieten mentions the case of a girl who was imbecile till she received an injury to the head and underwent an application of a trephine for the removal of a portion of a depressed skull; she recovered and became intelligent.

(c) **Operations causing Insanity**.—Surgical operations may in very, very rare instances be followed after three or four days' quiescence by insanity. There may be complete absence of hereditary taint, or, on the other hand, the neurotic tendency is strongly manifested. The writer's experience leads him to believe that insanity occurring after an operation in those who have no hereditary taint is more apt to prove incurable than in

those who have a strong hereditary factor, which means ready breakdown and equally ready recovery. It is, of course, essential to exclude the toxic factors (*i.e.*, poisoning or drugs) of causation. Sometimes the administration of an anæsthetic is followed immediately by insanity, the patient never really recovering from the unconsciousness due to the anæsthetic. On the other hand, the mere shock of the operation itself is sometimes sufficient to determine the insanity. In this relation we must note that the emotional state induced by anticipation of an operation may be a predisposing factor.

### Cure.

The mere existence of cure is exceedingly difficult to establish. After traumatic dementia, the absence of vertigo when stooping or looking down from a height is a fairly good test whether recovery has taken place.

In the organic cases, the symptoms, coming on as they do some time after the injury, becoming slowly progressive, and indicating the existence of a structural lesion, are necessarily of very unfavourable import so far as curability is concerned.

### Return to Work.

No time can possibly be fixed generally for return to work after a mental breakdown caused by an accident. Each case must be treated on its merits.

### Recurrence.

There is always considerable likelihood of recurrence, and one attack of mental disturbance is very likely to be followed by another at a later date. This may be partly the result of suggestion, which is discussed above, under Disease existing before the Accident, of which puerperal insanity is a good example, for the occurrence of one attack of puerperal insanity leads the woman to expect a similar attack at her next parturition.

Epilepsy is by its very nature periodic and recurrent, but an attack of epilepsy in childhood may be followed by one very late in life, after a long interval of apparent cure.

### Diagnosis.

The diagnosis of neurasthenia is determined by the absence of symptoms of organic disease and of those characteristic of insanity.

When neurasthenia or hysteria occurs in connection with an injury, the symptoms do not differ from neurasthenia or hysteria due to other causes.

A history of neurotic inheritance, nervous exhaustion, injuries, stress and strain, inanition, etc., together with the existence of the sensory, mental and physical characteristics of neurasthenia, will tend to make the diagnosis clear.

Litigation is apt to complicate matters considerably, and not infrequently tends to bring about an exaggeration, or even simulation, of diseased mental or bodily states, which cease only upon the completion of the litigation.

The account of the accident given by the injured man cannot be trusted, for, in addition to malingering, discussed below, there is another source of fallacy in the record of facts in connection with an injury as given by the injured man. This fallacy depends upon the psychical element of expectancy, anticipation, and auto-suggestion, which are discussed above, under Disease. The anticipation of an injury may have so great an influence upon the body and its functions that, independent of an injury, the incidence of some factor may induce effects almost identical with those which would have been caused by an injury. There is an abundance of such instances on record, but it is not sufficiently well recognized that the patient's knowledge of the actual cause of the injurious effect is apt to continue perverted for some time after the accident. In the hysterical and insane it is common to see not only anticipation of the effects of injuries which have never happened, but when effects resembling those produced by an accident are induced by other than the anticipated causes, there is still persistent belief that their anticipations were realized in the manner thought of or imagined by them. In these cases the individuals need not necessarily have been under the influence of alcohol at the time of the injury.

The diagnosis between epilepsy and hysteria is often difficult, but there are many points of difference between the two conditions.

In epilepsy there is no apparent cause ; the warnings are usually unilateral or epigastric aura ; the onset is sudden, and the patient usually screams ; rigidity is followed by jerking ; the tongue is bitten ; micturition is frequent ; occasionally defæcation occurs ; the patient never talks ; the attack lasts a few minutes ; restraint is necessary to prevent accident ; the termination is spontaneous. Warmth and perspiration are present during the fit.

In hysterical attacks, on the other hand, the cause is usually some emotion ; the warning is palpitation, malaise, choking ; the onset is gradual ; screams occur during the course of the attack ; the convulsion is attended by rigidity or struggling, throwing about of limbs or head, arching of back ; the lips, hands, or other people and things are bitten ; micturition and defæcation never occur ; talking is frequent ; the attack lasts more than ten minutes, often much longer ; restraint is necessary to control violence ; the termination is spontaneous or induced (Gowers, "Diseases of the Nervous System," vol. i., p. 758). If the symptoms closely follow a strong emotion, such as fright, or if they follow upon the observation of similar symptoms in others, they are probably hysterical. Convulsions in which consciousness is partially retained and words uttered, or in which the movements and attitudes express purpose and emotion, and friends vainly try to hold the struggling patient, are always hysterical.

### **Malingering.**

The diagnosis of feigned insanity is much more difficult, and can only be made clear in some instances after close and prolonged scrutiny. As a rule, real lunatics seldom desire to prove themselves insane. On the contrary, they more commonly seek to conceal the evidences of their insanity. The sane cannot feign insomnia for any lengthy period without detection, and in the pretender there is generally a kind of hesitation and reflection to be observed in his conversation.

Idiocy is seldom feigned, and when feigned is easy of detection.

Dementia also is but rarely imitated, and when it is imitated the fraud is seldom long continued. Sometimes the question is settled by the existence of symptoms of physical injury to the brain, which under no circumstances could be imitated (see Guy and Ferrier, "Principles of Forensic Medicine," p. 259).

Apoplexy is not often feigned except by those who hope for escape from impending punishment. It is difficult to simulate, and feigned apoplectics cannot resist the action of sternutatories ("sneeze-producers"). Epilepsy, however, is much more frequently feigned. In all suspicious cases it is important to note if the face is livid, the pupil fixed, the lips pale, the mouth distorted and frothy, etc. It must also be noted if sleep follows the paroxysm. The effects of sternutatories and the pricks of a pin may also lead to detection. If the hands of the real

epileptic be forced open, they remain expanded, but the feigned will immediately close them again (Marc Orfila's "Leçons," vol. i., p. 414).

In feigned cases the muscles do not stiffen or contract, as in real ones, hence continued action of the antagonist ones will expose the fraud.

Where profound immediate effects are produced by an injury, subsequent elaborate and detailed descriptions of events immediately preceding the injury should be received with caution, inasmuch as the patient, by the mere clearness of his memory for the events, suggests that he may have been malingering.

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*For legal cases and notes on Insanity see CASE GUIDE: Insanity.*



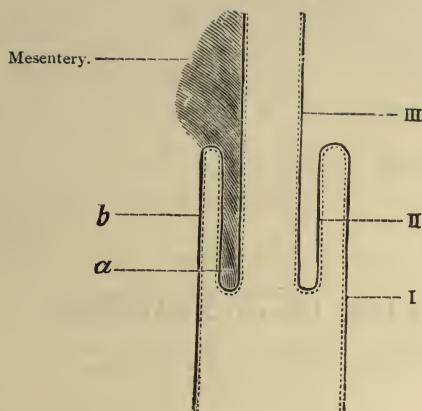


FIG. 111.—DIAGRAM OF THE PROCESS BY WHICH INTUSSUSCEPTION OCCURS.

III is the contracting part of the bowel, coming down from above into the wide part, I. The folding of the walls at *a*, *b*, and II, indicate the telescopic effect produced.

(From Rose and Carless's "Surgery.")

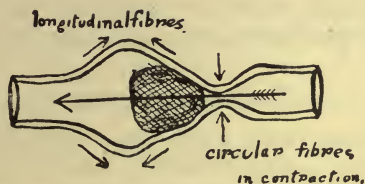


FIG. 112.—DIAGRAM TO SHOW THE PROCESS OF CONTRACTION OF THE BOWEL, BY MEANS OF WHICH THE FOOD IS PASSED ALONG IT, AND IN SOME CASES INTUSSUSCEPTION OCCURS.

The alternate contractions of the circular and longitudinal muscle fibres, as seen in the diagram, pass on the food, or, in some cases, even the part of the bowel itself.

(From Spourell's "Elementary Physiology.")



FIG. 113.—STRANGULATION BY A BAND OR ADHESION, THE RESULT OF OLD PERITONITIS, THE ENUDATION PRODUCED BY WHICH HAS DEVELOPED INTO A FIBROUS BAND.

The bowel has passed through the loop formed by the band, through which some of the contents of the bowel have been passed down into the constricted intestine, from which they cannot escape.

(From Rose and Carless's "Surgery.")

# THE INTESTINES.

By JAMES SHERREN,

F.R.C.S.,

Surgeon to the London Hospital; Surgeon to the Poplar Hospital  
for Accidents; late Erasmus Wilson Lecturer,  
Royal College of Surgeons.

## Head-note.

THE two important results of accident to the intestine are obstruction, and peritonitis from leakage of the contents of the bowel.

## Technical Terms.

*Adhesions.*—Fibrous tissue formed as the result of inflammation, and binding together parts that were formerly movable. [Fig. 113.]

*Ānus.*—The external opening of the back-passage (rectum). [Fig. 2.]

*Ānus, Artificial.*—An artificial opening from the bowel on to the skin, through which it discharges all its contents on to the surface of the body. It is usually deliberately made at an operation to relieve intestinal obstruction, but may in rare cases arise as the result of injury.

*Cæcum.*—The *intestinum cæcum*, or blind bowel, is the commencement of the large bowel, or colon, and extends below the point at which the small bowel joins it. It is about 2 inches long, and lies in the right lower part of the belly. [Figs. 9, 10.]

*Cōlōn.*—The large intestine excluding the cæcum and rectum. [Figs. 2, 9, 10.]

*Dūōdēnum.*—The first twelve finger-breadths of the small intestine (See below, Anatomy.) [Figs. 149, 170, 173.]

*Fistūla.*—An abnormal communication between a hollow organ and the skin, or between two hollow organs.

*Fistūla, Anal.*—An abnormal passage between the end of the back-passage (rectum) and the surface of the body. It opens on to the skin near the anus.

*Fistūla, Fæcal.*—An opening between the skin and the bowel through which some of the intestinal contents pass. Distinguished from artificial anus, through which all of the intestinal contents escape externally.

*Hēpatic.*—Connected with the liver.

*Īleum.*—The terminal portion of the small bowel. It is about 13 feet long. [Fig. 2.]

*Īlēō-Cæcal Valves.*—Folds in the large intestine at its junction with the small intestine to prevent the bowel contents returning into the small intestine.

*Īntūssūscēption.*—The telescoping of a portion of bowel into that immediately below. This is generally found at the junction of the large and small bowel. (See Children.) [Figs. 111, 112.]

*Īschō-Rectal Fossa.*—The space between the rectum and the ischium. The ischium is part of the large bone which forms the side wall of the pelvis.

*Jējunum.*—The middle part, about 9 feet long, of the small intestine, between the duodenum and the ileum. [Fig. 2.]

*Mēsēntēry.*—A fold of the lining membrane of the abdomen which attaches the bowel to the back of the belly. [Figs. 150, 153.]

*Pāncreas (the Sweetbread).*—A solid organ secreting a digestive juice. It lies across the abdomen above the level of the navel. [Fig. 149.]

*Pēritōnēum.*—The membrane lining the abdomen and covering the abdominal organs. [Figs. 150-153.]

*Rēctum.*—The lower end of the bowel (the back-passage). [Fig. 2.]

### Anatomy.

The intestine (bowel) is the portion of the alimentary tract below the stomach. It is divided into the small intestine and the large intestine. The small intestine has an average length of 22 feet. It is divided into three portions—duodenum, jejunum, and ileum.

The duodenum is a horseshoe-shaped loop of bowel which starts from the end of the stomach (the pylorus), and its length is about twelve finger-breadths (hence its name). [Figs. 170, 173.] The loop partially encircles the head of the pancreas, the duct of which opens into it by the same orifice as the duct from the liver (the bile-duct). [Fig. 149.] The end of this loop lies at the back of the belly and crosses in front of the spine. The duodenum is entirely behind the peritoneum, by which its front surface only is covered. Its end is marked by the looped intestine taking a sharp turn forward to begin the jejunum.

There is nothing to mark the division between the jejunum and ileum; it is quite arbitrary. The jejunum is the first 8 or 9 feet. [Fig. 2.] The jejunum and ileum are attached to the back wall of the abdomen by means of the fold of peritoneum called the "mesentery," in which run the vessels and nerves by which they are supplied.

The mesentery at its attachment to the wall of the abdomen measures only 6 inches in length; it spreads out in a fan-shaped manner to reach the bowel and encircle it. [Figs. 150-153.] The jejunum and ileum lie in folds which have a general transverse direction across the abdomen. The small intestine joins the large in the right lower quadrant of the belly.

The large intestine starts in the right lower part of the abdomen, as the colon, into which the small intestine and appendix open. [Figs. 2, 9, 10.] The part of the colon immediately below the entrance of the small intestine rounds off into a blind end called the "cæcum." The colon passes upwards in the right flank (the ascending colon); then loops downwards just under the liver (the hepatic flexure of the colon), and crosses the middle line about the level of the navel (the transverse colon); then passes upwards to the left, when it makes a bend downwards (the splenic flexure). It then passes down in the left flank (the descending colon), and forms a loop in the left lower portion of the abdomen (the sigmoid flexure of the colon). It ends as a straight tube (the rectum), which opens on the surface as the anus. [Fig. 2.]

The intestine has three coats: an inner mucous coat (mucous membrane), which is made up of glandular cells (these secrete a digestive juice and absorb the products of digestion); a middle muscular coat, which is in two layers, an outer longitudinal and inner circular [Fig. 111]; and an outer coat (the peritoneum), which last covers the intestine to a varying extent in different parts.

The jejunum, ileum, appendix, cæcum, transverse colon, and sigmoid flexure, all have a mesentery, and are completely covered by peritoneum. The duodenum, the ascending and descending colon, and the end of the rectum, are only partially covered by peritoneum, and that chiefly in front. [Figs. 150, 151, 152.]

### Consequences of Accident.

Injuries to the intestines may result in—

- (i.) Contusions.
- (ii.) Wounds.
- (iii.) Rupture.
- (iv.) Obstruction.

(i.) **Contusions.**—These result from direct abdominal injury, and, when no more than a transient bruising of the wall of the bowel, lead to very little ill-effect.

(ii.) **Wounds.**—The small intestine is more often wounded than the great. If the wound is minute it may be closed naturally, with no leakage of its contents, by the protrusion of its lining membrane (mucous membrane), which is only loosely attached to the underlying coats. In some cases the wound is closed by adhesion of the intestine to neighbouring structures; but this does not often happen. A wound of intestine usually leads to leakage of its contents into the abdominal cavity, producing peritonitis.

The rectum may be wounded by the entrance of foreign bodies through the anus, or through the neighbouring region on either side (ischio-rectal). [Fig. 2.]

(iii.) **Rupture.**—This most often results from crushes, and is a frequent cause of death after “run-over” accidents. The small intestine at the junction of the duodenum and jejunum, is the part most often injured in this way, then the lower part of the ileum at its junction with the colon, owing to their firm attachment to the back wall of the belly at these points.

A diseased rectum may be ruptured by the injection of fluids or air; in rare cases by a sudden abdominal strain, as in lifting a heavy weight.

(iv.) **Obstruction.**—Under the term “intestinal obstruction” are included two distinct types of cases:

(a) A simple obstruction to the onward passage of the intestinal contents. This may result from the contraction of the scar tissue formed in the healing of a wound, of a rupture, or of a contusion, and will show itself some considerable time after the accident.

(b) Obstruction, with cutting off of the blood and nerve supply of the portion of gut affected (strangulation). Of this type are the acute cases of intestinal obstruction. The symptoms may date from a sudden strain, or the strangulating agent may be a peritoneal band due to old adhesions formed as the result of past peritonitis. [Fig. 113.]

### Disease.

I. **Produced by the Accident.**—(i). After contusion of the intestine: Inflammation; ulceration; narrowing (stricture); peritonitis, local or diffused; intestinal obstruction.

(ii. and iii.) Wounds or rupture of the intestine may lead to peritonitis, intestinal obstruction, fæcal fistulâ or artificial anus, anal fistula.

(i.) **Contusion of Intestine.**—*Inflammation.*—The more fixed

portions of bowel, the duodenum and ascending and descending colon, are the parts usually bruised. As a rule all the symptoms rapidly disappear. In a few cases inflammation supervenes, which may show itself simply by diarrhœa, or the inflammation may spread through the bowel wall and reach the peritoneal coat of the bowel, setting up peritonitis and adhesions. These adhesions may later on cause intestinal obstruction. (See below.)

*Ulceration of the Bowel.*—An ulcer may form as the result of the inflammation, and may perforate through the wall of the bowel and lead to leakage of intestinal contents into the abdominal cavity. Diffuse or general peritonitis and death, or a local peritonitis and an abscess, may be the result.

*Intestinal Obstruction.*—This may result from the scar tissue formed within the bowel in the healing of a chronic ulcer or wound. This variety of obstruction is slow in onset and progress (chronic). The resulting adhesions—formed as the result of local or diffuse peritonitis which is due to a contusion, a wound, or rupture of bowel—may cause acute intestinal obstruction.

In most cases it is the small intestine that is affected. The following are the principal varieties of intestinal obstruction of this type, in all of which the blood-supply is partly or entirely obstructed or cut off:

*Strangulation by Bands.*—The bands may be formed of peritoneal adhesions, and are in the majority of cases the product of past peritonitis. [Fig. 113.]

*Intussusception.*—Intussusception is the telescoping of one part of the bowel into another. It is very rarely the direct result of accident, but may result from the irregular muscular contraction of the intestine following on an accident. It usually affects the small bowel, and is common in children from disease. (See Children.) [Figs. 111, 112.]

*Volvulus.*—A volvulus is a twisting of a loop of bowel on its axis in such a way as to tighten and obstruct not only the onward passage of intestinal contents, but also to cut off the nerve and blood supply of the affected portion of gut. The part affected is most often the loop near the end of the large intestine (the sigmoid flexure of the colon). The predisposing cause is usually long-standing constipation, which has led to distension of the gut, and often to inflammation and stretches of its mesentery. The exciting cause may be a sudden strain.

(ii. and iii.) **After Rupture and Wounds.**—*Peritonitis.*—The escaped intestinal contents will lead to peritonitis, generally

diffuse, and this will cause the death of a patient unless there be immediate operation.

*Intestinal Obstruction.*—See above.

*Fæcal Fistula or Artificial Anus.*—These may occur as the sequel of a wound or rupture of bowel with escape of intestinal contents on to the surface of the body. It most often follows the development of an abscess.

A fæcal fistula or artificial anus may be made by operation in the treatment of intestinal obstruction.

*Anal Fistula.*—A wound at the side of the opening of the back-passage (anus) or swallowed bodies, as pins or fish-bones, may penetrate into the bowel, and lead to the formation of an abnormal passage, which will not close. An abscess at the side of the anus may arise from a contusion or a wound, and bursting may lead to the formation of an anal fistula.

It must be remembered, however, that these are very rare occurrences. In most cases an anal fistula has nothing whatever to do with injury, but is sometimes the outcome of disease—*e.g.*, tuberculosis.

**2. Existing before the Accident and aggravating its Effects.**—Bowel that has been distended as the result of a chronic intestinal obstruction from various causes is more liable to rupture than healthy gut. A cæcum may be so ruptured when distended and even ulcerated, as the result of long-standing obstruction in the lower bowel (the sigmoid portion of the colon). This rupture may take place as the result of a sudden strain. In case of prolapse of the rectum, a sudden strain has produced a rupture of the rectum.

Old peritoneal adhesions due to previous disease—*e.g.*, a former attack of appendicitis—or the reduction of a strangulated hernia (rupture), may easily produce intestinal obstruction under only a slight strain.

### Operation.

(i.) **Contusion.**—Operation is only required after contusion when complications, such as the formation of an abscess or peritonitis, supervene.

(ii. and iii.) **Wounds and Rupture.**—Operation is urgently necessary to obviate peritonitis in all cases in which injury to the intestine has occurred.

To be successful it must be carried out within a few hours of the injury. The operation consists in closure of the opening

in the bowel, washing out the abdominal cavity, and, if necessary, providing for drainage.

There is no special risk attached to operation, while death is certain without it.

(iv.) **Intestinal Obstruction.**—*Acute.*—In acute intestinal obstruction, if life is to be saved, operation must be performed at the earliest possible moment; twenty-four hours' delay will make 75 per cent. difference in the chances of recovery. Operation consists in removing the cause of the obstruction, and in some cases opening and draining the distended bowel by an artificial outlet (fæcal fistula or artificial anus). This may have to be closed at a subsequent operation.

*Chronic.*—Operation is by no means always necessary in every case of chronic intestinal obstruction, because it is not urgently called for as a life-saving measure. But if the obstruction is leading to abdominal pain, or to distension, operation should be undertaken. In most cases it will consist in removal of the narrowed portion of bowel and restoration of the continuity of the intestinal tube, or it may be wiser in certain cases to do a short-circuiting operation. Either operation carries little risk. The danger to life is in infection of the peritoneal cavity by escape of intestinal contents, in the necessary opening of bowel during the operation.

**Fæcal Fistula and Artificial Anus.**—The operation consists in closing the opening, which may entail removal of the affected portion of the gut. The danger of the operation consists in infection of the peritoneal cavity with the contents of the bowel during the freeing of the edges of the opening preparatory to sewing them together, for the bowel in a fæcal fistula is always adherent to the wall of the belly. The risk, however, is not very great.

**Anal Fistula.**—Operation in this condition is practically devoid of risk. It consists in cutting through the fistula from its internal to its external opening. The muscle closing the anus is necessarily divided in this operation, but heals up readily during the process of cure. An anal fistula, especially if due to disease, may recur after operation.

### Cure.

(i.) **Contusion of Intestine.**—If there are no complications, cure results in less than a week, but it may be followed at a later period by intestinal obstruction. About 90 per cent. of these cases are well in a week.



(ii. and iii.) **Rupture or Wound of Intestine.**—As in other abdominal operations, if no complications arise, cure is complete in about two months. But peritonitis or a fæcal fistula may complicate and prolong indefinitely the progress of the cure. In these cases cure can be said to have taken place in two months from the healing of the wound. But these complications make the patient more liable to intestinal obstruction, to post-operative pain due to adhesions, and to post-operative hernia. (See Rupture—Ventral Hernia.)

(iv.) **Intestinal Obstruction.**—In an uncomplicated case two months suffice for cure. If it has been necessary temporarily to drain the bowel by establishing an opening externally (artificial anus or fæcal fistula), which may require a second operation, cure cannot be expected under six months from the date of the first operation. This time of cure postulates the most favourable circumstances.

**Fæcal Fistula or Artificial Anus.**—Two months at least will be necessary for operation and recovery.

**Anal Fistula.**—Cure cannot be expected under two months, and a much longer time is not uncommonly necessary.

### Return to Work.

In all cases in which the operation has necessitated an opening into the abdominal cavity, the time at which return to work may be expected, and the kind of work which can be undertaken, depend *inter alia* upon the condition of the abdominal wall. (See Rupture—Ventral Hernia, p. 693.)

(i.) **Contusion of Intestine.**—In an uncomplicated case the patient may return to any variety of work in about a week.

(ii. and iii.) **Wounds or Ruptures of Intestine.**—In uncomplicated cases the patient may return to any kind of work within three months from the date of operation. If severe bleeding has complicated the operation, or if an abscess has formed or peritonitis has supervened, the time is much prolonged, and the patient may never be fit for heavy work again.

(iv.) **Intestinal Obstruction and Fæcal Fistula.**—See above, Cure.

**Anal Fistula.**—Full work may be resumed in about a month from the date of healing of the wound.

### Recurrence.

Anal fistula, especially when caused by disease, may recur after an operation, but seldom does.

Injuries, by causing the formation of peritoneal adhesions, months, or even years, after it is inflicted, may lead to intestinal obstruction. Such adhesions may have formed after operation. Apart from these there is no liability to recurrence in the case of injuries to the intestine.

#### Occupation.

There is no occupation which confers a special liability to intestinal accident.

#### Diagnosis.

See Abdomen.

#### Malingering.

See Abdomen.

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*For legal cases of Injury to Intestines see CASE GUIDE: Intestines.*

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## INTUSSUSCEPTION.

*See* INTESTINES.

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## JAW.

*See* BONES, TEETH.

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## JEJUNUM.

*See* INTESTINES.

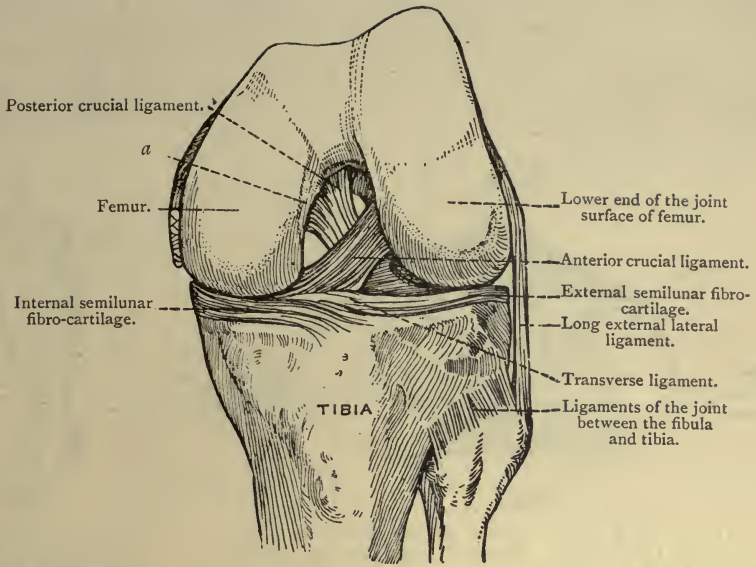


FIG. 114.—THE LEFT KNEE-JOINT OPENED FROM THE FRONT. THE LOWER END OF THE THIGH-BONE (THE FEMUR) IS SHOWN, AS THE KNEE IS BENT, THE SMOOTH SURFACE BEING THE ARTICULAR CARTILAGE.

The kneecap and casing of the joint (the capsule) are removed.

(From Buchanan's "Anatomy.")

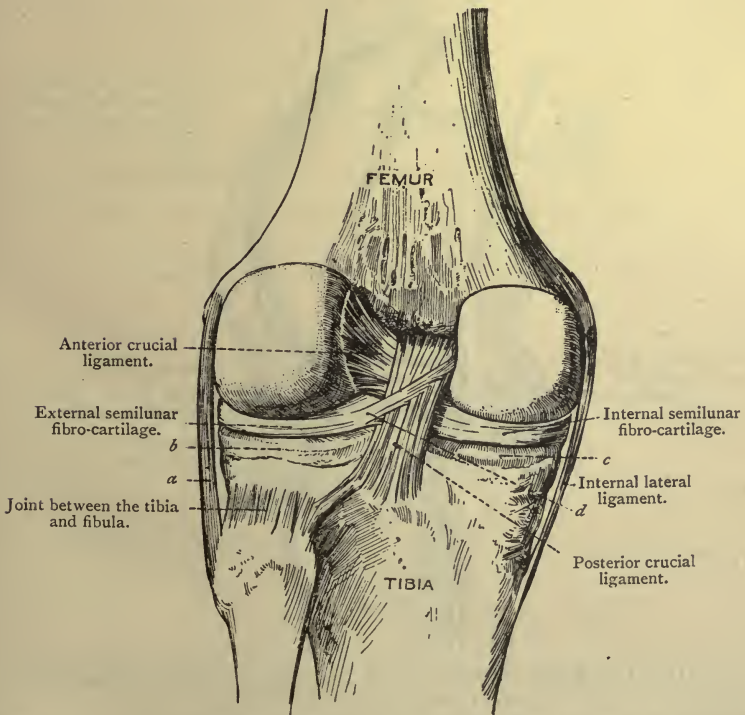
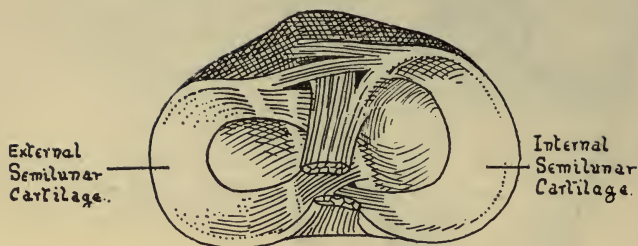


FIG. 115.—BACK OF THE LEFT KNEE WITH THE CASING (CAPSULE) REMOVED. The knee is straight. The letters *a* to *d* indicate named parts.

(From Buchanan's "Anatomy.")

Front.



Back.

FIG. 116.—THE UPPER SURFACE OF THE TIBIA AND SEMI-LUNAR CARTILAGES, FORMING THE LOWER HALF OF THE LEFT KNEE-JOINT.

The two cut ligaments are the anterior and posterior crucial ligaments. (See Figs. 114, 115.)



FIG. 117.—THE LEFT KNEE SEEN FROM THE FRONT, WITH THE TWO SEMI-LUNAR CARTILAGES REMOVED AND SHOWN AT EACH SIDE, OPPOSITE THEIR POSITION IN THE KNEE-JOINT.

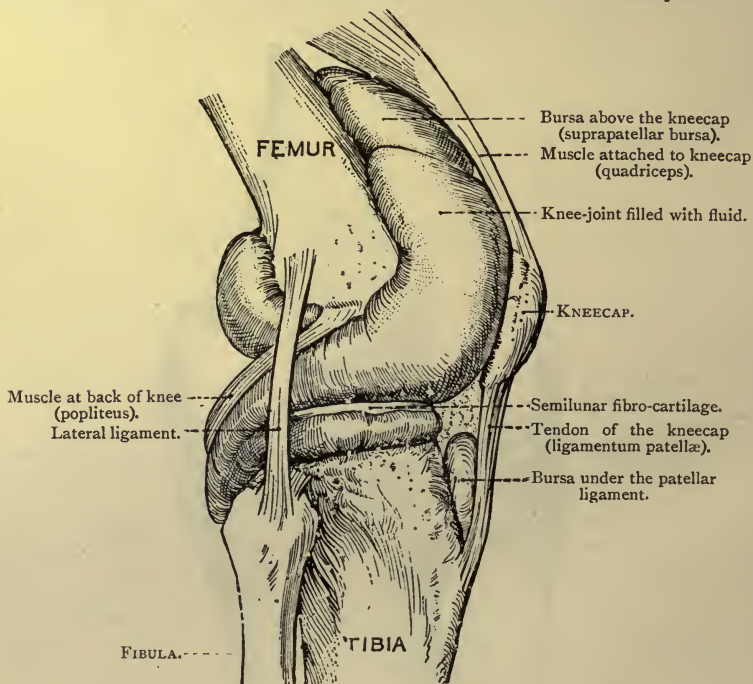


FIG. 118.—THE RIGHT KNEECAP WITH THE VARIOUS PARTS OF THE JOINT CAVITY DISTENDED WITH FLUID.

The casing (capsule) and most of the muscles have been removed. The prepatellar bursa, the bursa in front of the kneecap, which is enlarged in housemaid's knee and miner's knee, is not shown. (See Figs. 55, 56, 57.)

(From Buchanan's "Anatomy.")



FIG. 119.—NORMAL FEET, SHOWING THE ARCH.



FIG. 120.—FLAT-FOOT, SHOWING THE LOSS OF THE ARCH.

(From Rose and Carless's "Surgery.")



FIG. 121.—"LOOSE BODY" FROM A JOINT, SEEN FROM THE SURFACE AND IN SECTION.

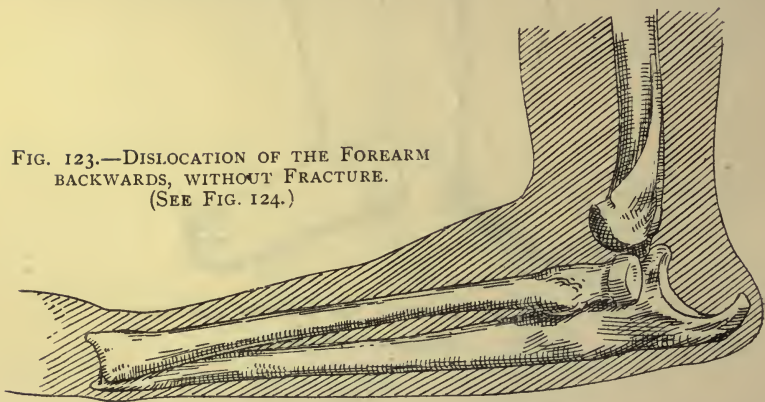
A, Cartilage; B, bone.

(From Rose and Carless's "Surgery.")



FIG. 122.—DISLOCATION OF THE SHOULDER.  
The head of the humerus is dislocated downwards and forwards.

FIG. 123.—DISLOCATION OF THE FOREARM BACKWARDS, WITHOUT FRACTURE.  
(SEE FIG. 124.)



Coronoid process  
broken off

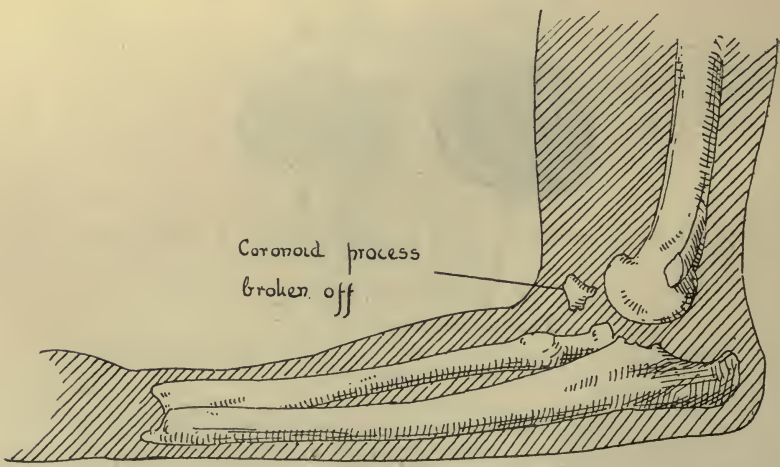


FIG. 124.—DISLOCATION OF THE FOREARM BACKWARDS, WITH FRACTURE OF PART OF ONE OF THE BONES OF THE ELBOW (THE CORONOID PROCESS OF THE ULNA).

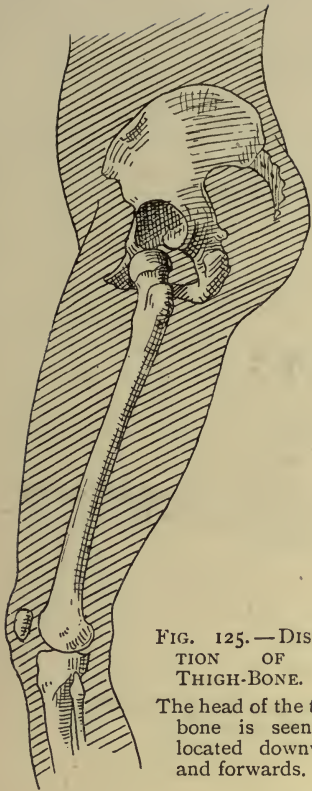


FIG. 125.—DISLOCATION OF THE THIGH-BONE.

The head of the thigh-bone is seen dislocated downwards and forwards.

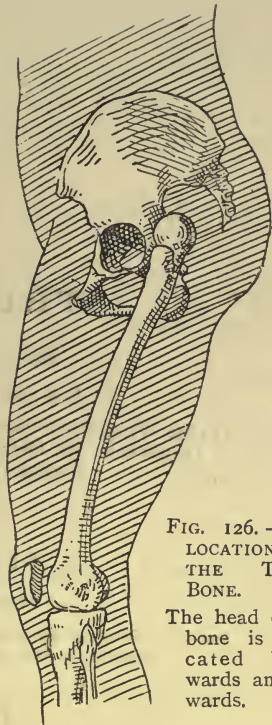


FIG. 126.—DISLOCATION OF THE THIGH-BONE.

The head of the bone is dislocated backwards and upwards.



FIG. 127.—OSTEO-ARTHRITIS, RHEUMATOID ARTHRITIS, OR ARTHRITIS DEFORMANS. THE KNEE-JOINT OF A MAN WHO SUFFERED FROM THIS DISEASE.

The joint is opened from the front, and the kneecap turned downwards. The cartilages are partly eroded, and deep grooves are formed in the opposing surfaces of the bones of the joint, which are hardened and polished by the direct friction.

(From Rose and Carless's, "Surgery.")

# THE JOINTS.

By A. H. TUBBY,

M.S. (LOND.), F.R.C.S. (ENG.),

Surgeon to the Westminster Hospital and to the Royal National Orthopædic Hospital for the Deformed; Consulting Surgeon to the Evelina Hospital for Children;

AND

E. ROCK CARLING,

B.S. (LOND.), F.R.C.S. (ENG.),

Assistant-Surgeon to Westminster Hospital; Senior Assistant-Surgeon to the Seamen's Hospital, Greenwich.

## Head-note.

THE results of accident upon the joints may be considered under the following heads:

Local:

- (a) Impairment of function.
  - 1. Impaired mobility, or fixity.
  - 2. Impaired stability.
  - 3. Deformity.
- (b) Disease.

General:

- (c) Constitutional effects of suppuration.
- (d) Extension of infection — pyæmia (the distribution of matter or pus about the body).

## Technical Terms.

*Āpōnēūrōsis*.—A flat sheet of fibrous tissue to which muscle fibres are attached.

*Ārthritīs*.—Inflammation of the constituent parts of a joint.

*Ārthritīs Deformans*.—A chronic degeneration of the bone and cartilage of a joint, resulting in partial or entire loss of its functions. (Also called "rheumatoid arthritis" and "osteo-arthritis.") [Fig. 127.]



*Ankylosis*.—Limitation, and sometimes loss, of movement of a joint. It is either partial and fibrous or bony and complete.

*Articular Cartilage*.—The thin layer of cartilage covering the surface of a bone which moves upon the opposing surface of bone in a joint. [Fig. 114.]

*Bursa, True*.—A “water cushion” normally placed over bony prominences to lessen friction. Some bursæ communicate with the neighbouring joints. [Figs. 55, 56, 57, 118.]

*Bursa, False*.—A similar structure, developed from lymphatic spaces by long-continued, intermittent pressure over some bony prominence usually not so protected from friction.

*Capsule*.—The fibrous investment of the portions of bone entering into a joint.

*Cartilage*.—See Articular Cartilage.

*Charcot's Disease*.—A peculiarly destructive disease of the joints, occurring as a complication of locomotor ataxy.

*Dislocation*.—There are various kinds of dislocation.

*Compound*.—A dislocation accompanied by such a breach in the soft parts as to expose the joint surfaces to the air, and therefore to the risk of direct contamination.

*Congenital*.—Present at birth.

*Pathological*.—Caused by the pull of muscles acting on a joint softened or damaged by inflammation or disease.

*Simple*.—A displacement from each other of the bony surfaces entering into the formation of a joint; it will be permanent unless relieved.

*Extravasation or Exudation*.—Fluid poured out into the tissues from the bloodvessels and lymphatics.

*Fasciæ*.—Sheets of fibrous tissue which envelop the tissues beneath the skin, and sometimes are found separating the deeper structures from each other. They invest and support many of the internal viscera—*e.g.*, the bladder and other pelvic organs. [Fig. 77.]

*Interarticular Cartilage*.—Buffers of cartilage between the ends of bone. In the knee they are called “semilunar cartilages.” [Figs. 114, 115, 116, 117.]

*Ligaments*.—Bands or bundles of fibrous tissue binding together the articular ends of bones. (For Ligaments of the Knee, see Figs. 114-118.)

*Pyæmia*.—Infection of the blood by microbes (*Streptococcus* and *Staphylococcus pyogenes aureus*). (See Infection—Pyæmia, p. 448.)

*Semilunar Cartilages*.—See Interarticular Cartilage.

*Sprain*.—A momentary disturbance of the normal relation which exists between the opposing bone surfaces of a joint

*Subluxation*.—Partial displacement of a joint.

*Suppuration.*—Formation of pus or matter. (See Infection, p. 444.)

*Synovial Fluid.*—The lubricating fluid of a joint or tendon-sheath.

*Synovial Membrane.*—A thin membrane which lines joints and tendon-sheaths. It secretes the synovial fluid.

### Anatomy.

A movable joint consists of the ends of two or more bones, covered with a smooth, thin layer of cartilage, and bound together by an investment of fibrous tissue, which is thickened in places, as it passes from one bone to the other. The thickened portions are known as “ligaments.” In addition to the fibrous investment, which is known as the “capsule,” the muscles which produce movements of the joint are attached to the bones, and pass across the joint.

In some instances—*e.g.*, the hip—the pressure of the atmosphere also helps in maintaining the apposition of the bones. Some joints have in addition plates of cartilage (interarticular) which partially or wholly intervene between the bone-ends; they serve to adapt accurately surfaces which otherwise would not coincide. These structures are seen in the lower jaw joint, collar-bone joint, and knee-joint.

The inner surface of the capsule, or fibrous investment, is lined by a smooth, thin membrane, which secretes sufficient fluid to lubricate the joint.

Fixed joints generally have a layer of cartilage between the opposed surfaces of bone, but the cavity, if any, is relatively insignificant. Such joints are seen between the lowest part of the spinal column and the haunch-bone (pelvis), between the bodies of the vertebræ, and in some other parts.

### Consequences of Accident.

- (i.) Contusions and bruises.
- (ii.) Strains and sprains.
- (iii.) Dislocation and subluxation, with or without fracture.
- (iv.) Wounds, penetrating and non-penetrating.
- (v.) Detachment of portions of cartilage or bone, with or without the formation of a loose body, within the joints. (This occurs, for example, in the knee.)
- (vi.) Fracture within the joint capsule.

(i.) **Contusions and Bruises.**—The effects are very slight, and usually do not prevent working.

(ii.) **Strains and Sprains (including "Sprain-Fracture").**—

A sprain is a momentary disturbance of the normal relation which exists between the opposing bone surfaces, and varies in degree. In some cases the injury producing it is slight and the effects very temporary; whilst in others it may be such as to rupture the ligaments, or even to tear away with the ligaments a small piece of the joint surface. The latter condition is as "sprain fracture."

The nature of the injuries to the parts is often complicated, and the disability resulting is frequently prolonged. The remark sometimes heard in court, that "a sprain is worse than a fracture," is a generalization, dangerous because only partly true. Probably what is meant is, that a sprain accompanied by a fracture is worse than a simple fracture, but the public are not aware that sprains may be complicated in this way. They wrongly look upon the two conditions as distinct, and therefore to be contrasted. The symptoms of a sprain are acute pain at the time of the accident, due to stretching and rupture of the ligaments, sudden effusion into the joint, and traction upon, or even tearing of, the soft tissues over the joint. In a short time swelling appears, while the movements of the joint, already limited, become still more restricted. After three or four days bruising beneath the skin is seen, and it is always most marked where damage is greatest. Some patients are possessed by the idea that it is good to walk off a sprain. They always suffer for their temerity.

After a sprain the patient complains of two troubles: persistence of pain and stiffness. The former is due to the fact that, owing to the injury, certain structures have been inflamed, and necessarily remain sensitive for a time when used. If a ligament has been partially torn away from a bone, when tension is placed upon that ligament pain is frequently felt at the site of its attachment, owing to effusion at that spot.

The joints most liable to sprains (which are due, generally, to some unexpected lateral or twisting force) are: Ankle, wrist, elbow, knee, shoulder; small joints of the hand and foot, especially the thumb-joint (metacarpo-phalangeal). (For Miner's Wrist, see Occupation Diseases, p. 500.)

(iii.) **Dislocation and Subluxation, with and without Fracture.**—**Dislocation.**—The varieties of dislocations met with are: Traumatic, or those which arise from injury; congenital, or those existing at birth in children; and pathological, or those occurring in disease, without any injury to cause them.

Traumatic dislocations are common in the active years of life, but they are also found at birth and in extreme old age. As a rule they are seen at the time when the bones are at their maximum strength—that is, from twenty-five to fifty years of age. They are more common in men than in women, because of the greater exposure of the male sex to violence which produces dislocation. Violence is usually applied indirectly, the limb acting as a lever, and it is generally in the nature of a wrench, a twist, or a crush. A crush is usually required to displace those joints in which the bones are closely bound together and movement is limited. Of this type the joints of the pelvis and spinal column are good examples.

**Dislocation with Fracture.**—Dislocation of some of the joints necessarily involves, or is accompanied by, a fracture of some portion of the joint surface of the bones. Thus, dislocation of the elbow is generally accompanied by fracture of part of the ulnar bone (the coronoid process).

Again, dislocation of the vertebræ, which articulate with one another by complicated joints, is nearly always associated with fracture of part of the bone.

**Subluxation.**—There is a condition known as “subluxation,” in which a partial displacement of the bones takes place not necessarily with rupture of the capsule; reduction is usually quite easy to effect, but recurrence is common. Any antecedent disease or injury leading to laxity of the capsule and ligaments predisposes to subluxation. It is commonly seen in the shoulder and lower jaw. The following are common dislocations:

(a) **THE ARM.**—*Shoulder.*—Dislocations of this joint are commoner than any other, partly because of the shape of the bony surfaces, which are adapted to the very free range of movement permitted, and partly because the long lever of the upper limb is naturally exposed to constant stresses.

There are three common varieties of this dislocation, described according to the position taken up by the head of the upper arm bone when displaced. [Fig. 121.]

*Elbow.*—The bones of the forearm may be displaced backward, forward, or to either side of the lower end of the humerus (upper arm bone); it is in the backward form that the coronoid process of the ulna is nearly always broken. A transverse fracture of the lower end of the humerus is sometimes mistaken for a backward dislocation. [Figs. 122, 123.]

*Wrist.*—Dislocation here is very uncommon; the direction of displacement generally seen is of the hand backwards upon the

two forearm bones (dorsal displacement). Compound dislocation, dislocation with exposure of the joint to the air, occurs sometimes in machinery accidents.

*First Joint of the Thumb (Proximal Phalanx upon Metacarpal).*—This accident is not uncommon, and has attracted an unusual amount of attention, because it is sometimes extremely difficult to reduce; frequently, however, it is replaced with ease.

(b) THE LEG.—*Hip.*—This joint is the strongest in the body, and were it not for the powerful leverage that can be brought to bear upon it through the thigh or the whole lower limb, it would seldom be dislocated. As it is the accident is rare, at any rate among Europeans, though it is said to be more common among certain races—*e.g.*, the Cingalese.

There are four common varieties, in two of which the head of the thigh-bone lies behind its socket (the acetabulum), whilst in the others it lies in front. There is one very powerful ligament, the Y-shaped ligament, which generally acts as a fulcrum and determines the “regular” or usual positions of the dislocated bones; when this is torn, very great displacement may be produced. The routine methods devised for reduction of the displacements depend for their efficiency upon the integrity of this ligament. In the rare cases in which it is torn, reduction may be exceedingly difficult. [Figs. 125, 126.]

*Knee.*—Simple dislocation of the knee is rare, and compound more so; in either case the damage to ligaments and other soft parts is necessarily severe.

*Ankle.*—Dislocation of the foot from the bones of the leg may take place in four directions—backwards, forwards, or to either side. The lateral displacements are seldom complete unless compound, and all the varieties are generally accompanied by fracture. (See Bones—Pott’s Fracture.) [Fig. 37, p. 124.]

The ankle-joint consists of the bones of the leg and one bone only of the foot—the astragalus. Dislocation is likely to happen when the toes are out-stretched. Instead of dislocation occurring at the ankle, it sometimes happens between the astragalus and the bones of the foot in its immediate neighbourhood—“sub-astragal dislocation.”

(c) JAW.—Displacement of the lower jaw from its articulations at the base of the skull may take place on one or both sides. It occurs from opening the mouth widely in yawning, or in attempting too big a bite, or from a blow on the chin with the mouth open.

(d) **COLLAR-BONE.**—The inner end of the collar-bone may be displaced backward, forward, or upward; it is only the backward position that is of any great importance, because important structures may be pressed upon—viz., the windpipe and the great bloodvessels of the neck.

The outer end may also be displaced from its connection with the blade-bone (scapula).

(e) **PELVIS.**—Forcible disruption of the joints of the pelvis or haunch is sometimes associated with damage to the organs in the vicinity, especially the bladder and its outlet tube (urethra), or the bowel. (See Bladder, Genital Organs—Male, p. 396.)

(iv.) **Wounds of Joints.**—It is customary to speak of non-penetrating and penetrating wounds of joints. The former are those implicating the soft tissues superficial to the joint; the latter pass through the joint casing (the joint capsule) into its cavity, and are grave.

A non-penetrating wound of a joint is much more serious than one occurring in the continuity of the limb. If it becomes inflamed (septic), the inflammation spreads to the joint tissues, and all the results of a dirty penetrating wound are seen. The joint which is most commonly wounded is the knee, as it is the most exposed of all the articulations. Such an accident may be of the most formidable description, and may be a menace to life, or even short of that it may necessitate amputation. The gravity of the wound depends upon whether matter is formed or not (septic infection). If this is averted or controlled, complete recovery may take place, or at any rate it will be possible to avoid complete fixity of the joint (ankylosis). Wounds of joints are always serious, because these structures possess tissues peculiarly suitable for the growth of bacteria, and the recesses of the joints are particularly difficult to drain satisfactorily.

(v.) **Detachment of Portion of Cartilage or Bone, with or without the Formation of a Loose Body within the Joint.**—The commonest cause of this condition is displacement of one of the semilunar cartilages, which generally results from some sudden stress thrown upon the joint, or a twist of the knee, as in dancing or jumping off a moving vehicle. The patient generally falls to the ground with the limb sharply bent; on trying to rise, he finds that an attempt to straighten the leg causes very severe pain, and a particular position or manipulation is necessary to release the parts. The joint quickly fills with fluid, and inflammation of the lining (acute synovitis)

results. With rest the symptoms may abate, but the first time any lateral or rotary strain is thrown on the part, as in walking or turning sharply or running, the cartilage, previously detached and not soundly healed after reposition, is again displaced, and then follows a fresh attack of synovitis. Such attacks may be repeated frequently, or only occasionally, and ultimately cause irreparable damage to the knee. Sometimes, when the cartilage cannot be coaxed back into position in the first instance, the joint movements remain more or less limited, and there is greater liability to recurrence of displacement. It must be understood that it is only when the displaced or movable cartilage actually intervenes between the contact surfaces that the acute pain and severe symptoms are present, and that there are recesses in the joint cavity where the cartilage may remain for a considerable period without doing much harm.

One of the interarticular cartilages (semilunar) may be broken across, and a portion become quite loose; or whilst intact may be partially or wholly separated from its attachments. [Figs. 116, 117, 121.]

In some instances there are no very severe or definite attacks with typical fixation of the limb in the flexed position. Very similar symptoms may be caused by detached pieces of cartilage, or by enlarged, elongated, and thickened portions of the folds of the synovial membrane.

**Loose Bodies.**—When a joint has been chronically inflamed, numerous small free bodies, like small melon-seeds, may be found in the joint fluid. They are derived from the “fibrin” of the inflammatory exudate, or from fragments of bone or cartilage broken off the bones of the joint. It was at one time thought that they were always tuberculous, but, though often found in tuberculosis, they may occur in any form of chronic inflammation, and in bursæ as well as in joints. [Fig. 121.]

(vi.) **Fracture of the Bones within the Joint Capsule.**—Among the most serious injuries to the joints are those in which a fracture in the neighbourhood extends to and involves the joint surfaces.

The best known of these is fracture of the knee-cap (patella). Blood is poured into the cavity of the joint and may form adhesions, while the excess of new tissue about the site of fracture, even when the fragments are properly apposed, alters the alignment of the normally smoothly fitting surfaces of the bones, and makes movement both painful and difficult. [Fig. 35.]

Other injuries of similar character are—

Pott's fracture (in some of its modifications), an injury to the bones forming the ankle. (See Bones—Pott's fracture.) [Fig. 37.]

Fracture of the lower end of the upper arm bone (humerus). [Fig. 28.]

Fracture (intracapsular) of the upper end of the humerus.

Fracture (intracapsular) of the upper end of the femur.

Fracture of the lower end of the thigh-bone (femur).

A fracture of the forearm bone (radius) close to the wrist, is very common in old women from falls on the outstretched hand. Even when it does not actually spread into the joint, it nevertheless produces a disturbance of the normal relations of the joint surfaces, which, with matting of the numerous tendons around the joint, results in serious loss of mobility in the wrist and fingers. (See Bones—Colles's Fracture.) [Fig. 31.]

Vertical fracture of the femur into the knee-joint results in serious deformity, but under skilful treatment a good result is sometimes obtained.

Vertical fracture of the tibia into the ankle-joint is followed by stiffness and partial or entire loss of mobility of the joint.

### Disease.

**General Considerations.**—The occurrence of disease in any situation may be looked upon as the result of several factors, among which hereditary influences, congenital anomalies, and injury, play important rôles. In many cases it is impossible to apportion with certainty the proper share of each factor, but there is no doubt that in the lay mind—and even amongst medical men, who are compelled to furnish the public with what seems to them an obviously efficient cause for every occurrence—the importance of injury is very much overrated. In many instances injury serves no more than to direct attention to a part already diseased; in others it is the spark to the carefully prepared mine. It determines the explosion, but the disease would have developed inevitably without the occurrence of any incident of sufficient magnitude to be designated “an accident.” Again, injury may lead to exacerbation of pre-existing disease; or, finally, may bear so definite a relation to the initiation of disease as properly to be regarded as its “cause.”



It should be remembered that an injury sometimes brings a patient to a doctor who would not otherwise have had an opportunity of examining him, and a disease which bears no relation to the accident may be discovered for the first time.

1. **Caused by the Accident.**—Injury alone cannot cause any of the common diseases to which joints are liable. Though tuberculous, syphilitic, rheumatic, pneumococcic, and gonorrhœal arthritis, gout and osteo-arthritis, may all follow on injury, yet it must be understood that they are diseases directly due to poisons, most of them of bacterial origin. To establish any causal connection between the accident and the outbreak of disease, there must be a direct sequence or march of events; where an interval of recovery occurs, the presumption is absolutely against the causal connection with the injury. It is impossible to lay too much stress upon this point.

As the result of injury, acute simple inflammation or the formation of matter (pus) may occur. In the former the joint almost always, and in the latter occasionally, under treatment recovers entirely. On the other hand, a greater or less degree of stiffness or fixation may ensue and persist. The fixation may be by actual continuity of the bone substance (bony ankylosis), and in any case the fixation may occur in a false position (deformity). Persistent or frequently repeated distension of the joint with simple fluid may result in such a degree of stretching of the joint-casing and ligaments as to render the limb unstable. Neither of these conditions is strictly regarded as disease. [Fig. 118.]

When matter-producing micro-organisms reach the cavity of the joint directly through a wound, or settle down in the parts injured, having been brought there by the blood-stream, the inflammation (suppuration) induced may spread by continuity to the neighbouring tissues, and severe constitutional symptoms result from the absorption of the poisons produced. When the bone is affected, the destructive process may be very slow and intractable, and in some cases this may lead to disease of the kidneys (lardaceous disease). (See Infection, p. 449.)

**Thrombosis** (Clotting of Blood in the Veins).—This may be produced by injury of the vessel walls at the time of accident, or by the spread of inflammation after the accident, or the vessels of a gouty person may become thrombosed after an accident. [Figs. 195, 196.]

**Septicæmia and Pyæmia** (see Infection).—Suppuration (formation of matter) in connection with the joints is occasion

ally followed by dissemination of the matter-producing organisms throughout the body. The conditions known as "septicæmia" and "pyæmia" may then result, with grave danger to life. Short of a lethal termination, the general bodily health may be seriously impaired, and the normal power of resistance to disease become diminished. Conversely, a focus of suppuration or of infection at any part of the body may lead to septicæmic or pyæmic implication of the joints (see Infection). Many of the acute specific diseases are occasionally complicated by inflammation of the joints; such are, scarlet fever, measles, smallpox, influenza, glanders.

**2. Existing before the Accident and aggravating its Effects.**—Injury can cause exacerbation of certain pre-existing diseased conditions.

**Rheumatoid Arthritis.**—One affection very common among the working classes in middle life and later, is that known as "osteo-arthritis," "arthritis deformans," or "rheumatoid arthritis," and it frequently happens that some injury to a joint affected with this disease results in temporary or permanent disablement. The hip is more often affected in this way than any joint, and the patient is generally unaware that there is anything wrong with any of the joints, although there may be obvious signs of the disease in several. Sometimes remission of the symptoms occurs, but in many cases the disease thenceforward makes rapid strides. [Fig. 127.]

**Tuberculosis.**—Joints with well-marked disease, such as tuberculosis, are rarely exposed to injury deliberately; that is to say, the patients are usually not able to work.

The cases where it can clearly be established that injury has caused the exacerbation are those in which the disease process has become, or was definitely becoming, quiescent before the date of injury.

**Flat-Foot.**—A very common condition brought before the medical expert is that in which flat-foot is said to have followed a sprain of the ankle or fracture of that joint. If a careful inquiry be made, it will be found that the flat-foot has preceded the injury, which was due to want of stability of the foot—the order of events being, first flat-foot, and then injury, and not the reverse, as is so frequently stated in the courts. The evidence derived from the conditions of the other foot is valuable, but it must be remembered that the degree of flat-foot is frequently unequal in the two feet. [Figs. 119, 120.]

**Gonorrhœa.**—A trivial bruise or sprain of a joint in an

individual the subject of gonorrhœa may determine a severe inflammation of the joint, but such inflammation is common without injury.

**Hæmophilia.**—In the subjects of that rare disease hæmophilia (bleeders), the smallest injury may be followed immediately by very persistent swelling of the joints, blood being poured out into the cavity. When this is repeated several times, the joint becomes disorganized. (See Children, p. 235.)

### Operation.

(i.) **Bruising.**—Bruising never calls for operation unless the amount of blood effused is so great as to threaten a very long period for absorption, or where matter forms; the formation of matter occurs very easily in big clots of blood beneath the skin. The operation, if blood-clot only is present, consists in cutting down so as to expose and clear out the clot, washing the cavity with an antiseptic, and sewing up again.

If matter has formed, the cavity must be drained, and the time required for healing may be several weeks instead of days.

(ii.) **Sprains and Strains.**—Sprains and strains may necessitate operation to break down adhesions of the cartilage-covered surfaces of a joint to one another, or of the tendons passing across the joint to their sheaths.

In the case of fracture sprain, to obtain the best possible result, it may be important to fix the detached fragment of bone by wiring or screwing.

Operation is rarely required for sprains that have been treated from the outset by proper massage, movements, or gymnastic apparatus.

(iii.) **Dislocations and Subluxation, with or without Fracture.**—Dislocations when simple, and when reduction is effected shortly after the accident, hardly ever require further operation. To reduce a dislocation, division of the ligament is necessary or advisable in a few instances—*e.g.*, thumb and about the ankle.

Old-standing dislocations frequently call for operation; but it is not every case that will benefit, as regards the usefulness of the limb, by an attempt to restore the parts to their normal positions. To effect complete restoration of the normal relation of the bones may involve extensive damage to the soft tissues around, and consequent impairment of movement or power.

Sometimes it is necessary to remove a portion of the bone to relieve the pressure on vessels or nerves, or to allow play to the muscles, and thus obtain a fairly useful limb.

Dislocations accompanied by fracture sometimes call for operation, as the only hope of complete restitution of function.

(iv.) **Wounds of the Joint, Non-Penetrating and Penetrating.**—Wounds of the parts immediately over a joint demand operation when there is any doubt as to the integrity of the joint-casing (capsule), especially if germs appear likely to have got in. An exploration is necessary, and may require an extensive incision; but if the capsule is found intact, and the depths of the wound are well cleansed with antiseptics, the skin can be sewn up, and will heal in ten days.

If the wound penetrate the joint capsule, and particularly if caused by a dirty instrument, the joint must be opened widely enough to permit thorough washing out and satisfactory drainage. If matter forms in the joint, radical measures are to be employed; the whole joint may have to be laid widely open, so as to give freedom of access for constant washing out of the farthest recesses.

It is sometimes necessary to amputate the limb, when the continued formation of matter cannot be prevented, and there is danger of general blood-poisoning.

(v.) **Detachment of Portions of Cartilage or Bone, with or without the Formation of a Loose Body within the Joint.**—Detached portions of cartilage or bone, whether entirely free within the joint or attached by a stalk, or “pedicle,” can be safely removed by operation without, as a rule, endangering the future usefulness of the joint. It must be borne in mind that *restitutio ad integrum* is not always possible when the damage to the joint caused by such bodies has been of long standing. [Fig. 121.]

The greatest danger of operations, involving as they do exposure of the joint cavity to the air, is infection by organisms, and serious infection has occurred even when joints have been operated upon by surgeons of the greatest experience and most scrupulous cleanliness of practice.

(vi.) **Fracture of the Bones within the Joint Capsule.**—This often requires wiring, screwing, or pegging, if the joint surfaces are to be restored even approximately to that accurate alignment so essential for smooth working. When the parts are exposed, it may be found impossible to restore the fragments to place.

#### Cure.

(i.) **Contusions and Bruises.**—With uncomplicated bruising perfect recovery may be anticipated in a week.

(ii.) **Strains or Sprains.**—Strains or sprains in which injury is slight, and mere stretching of the ligaments has taken place, generally recover within ten to fourteen days. Where the ligaments have been ruptured, it will be at least three or four weeks before the patient can use the joint, and even then there will be a considerable amount of pain and disability. With “sprain fracture” as much as five or six weeks elapses before the part can be used with any freedom. The same time should be allowed where operation has been undertaken within a day or two of the accident.

(iii.) **Dislocation and Subluxation.**—After reduction, the parts should be kept completely at rest for a period that varies with the particular joint, and then passive movements be commenced.

*Hip*: 3 weeks’ rest, 3 weeks’ movements; free use in 6 to 12 weeks.

*Knee*: 14 days’ rest, a month’s movements; free use not for many weeks or months.

*Ankle*: 10 days’ rest, 3 weeks’ movements, then free use.

*Shoulder*: 10 days’ rest, 3 weeks’ movements, then free use.

*Elbow*: 10 days’ rest, 3 weeks’ movements, then free use.

*Wrist*: 10 days’ rest, 4 weeks’ movements, then free use.

*Jaw*: Complete rest is almost impossible, but retentive apparatus should be worn for 14 days, and care must be exercised for a month or more.

*Collar-bone*: Though usually easily reduced, the normal position is difficult to maintain; rest for 3 weeks whether the bone is in position or not. In many cases it does not much matter if fixation occurs a little out of position. When operation is undertaken to relieve pressure on important structures or to insure exact replacement, 4 or 5 weeks’ rest must be allowed before free use is permitted.

*Pelvis* (haunch): Rest in bed for a month; free use of limbs in walking in 6 to 10 weeks from accident.

When a dislocation is complicated by fracture or separation of the epiphysis (the growing end of the bone) in the neighbourhood, the ultimate result, so far as the usefulness of the limb is concerned, is extremely problematical. In many cases reduction cannot be effected at once, because the leverage afforded by the bone is lost. Time must be given for the fragments to unite, and then reduction must be accomplished if possible; the attempt may fail, and the bone may be re-fractured.

Unreduced dislocations are seen from time to time. Reduc-

tion may be attended by grave risk, and may be impossible. Many serious accidents have followed such attempts; thus, bones have been fractured, important nerves or bloodvessels ruptured, and in an old person the limb has been actually torn off by prolonged efforts at replacement. Even with an unreduced dislocation a considerable amount of power and usefulness may be gained eventually.

In elderly persons stiffness and limitation of movement often persist indefinitely after a dislocation.

(iv.) **Wounds.**—(a) *Superficial Parts.*—Healing may be expected in ten days.

(b) *Penetrating the Joint-Casing.*—A clean wound healing without hindrance will be well in a fortnight. If the capsule has been widely opened, it should not be subjected to strain for four weeks; and in the case of the knee, even then, not without mechanical support. Massage should be employed to promote rapid recovery as soon as the superficial wound is healed.

For a joint in which matter has formed, no time for cure can be given. The joint may become ankylosed, and permanently more or less stiff. The patient may be about again with a stiff joint in any time from three to twelve months.

(vi.) **Detachment of Portions of Cartilage or Bone with or without the Formation of a Loose Body within the Joint.**—If seen at once and properly treated, and operation considered unnecessary, limited use with retentive apparatus will be permissible in twenty-one to twenty-eight days; perfectly free use in eighteen months.

For recurrent cases which demand an operation—ten days in bed following the operation, ten days on a couch, with massage and movements, are essential; then three weeks' restricted use, and complete recovery in three months from the operation.

(vii.) **Fracture of the Bones within the Joint Capsule.**—This is one of the most serious injuries to the joints; it is sufficient to say that if the patient regains partial movement he is fortunate.

### Return to Work.

**General Considerations.**—The time required for surgical cure may be considerably greater or less than that needed for a safe return to work. Thus, a sprained ankle will detain a house decorator from his work much longer than a similar injury to a watchmaker. The watchmaker, however, would be kept idle by a dislocation of his thumb long after the former,

affected by a similar accident to the left hand, would have returned to work. In giving definite times below, it is presumed that the injury involves a part of direct importance to the occupation. It is also presumed that the injured person has a direct interest in his earliest possible recovery, and that he is willing to assist the skilled efforts made to restore the *status quo ante*. It is common experience among surgeons, that so long as there is any possibility of gain from protracted incapacity the greatest difficulty appears to be encountered in getting these cases well. Recovery often involves active effort, grit, and determination on the part of the patient. When pain and discomfort exist, it is well known that return to work and distraction of the attention are most useful aids to recovery.

It is presupposed that treatment has been correct and efficient.

(i.) **Contusions and Bruises.**—As soon as surgical cure is complete.

*Simple Contusion*: 14 days. If infection occur, or disease be present, the period is prolonged. (See above, Operation.)

(ii.) **Strains and Sprains.**—

Ankle	:	according to severity,	from 2-6 weeks.
Knee	„	„	„ 14-42 days.
Wrist	„	„	„ 10-28 „
Thumb	„	„	„ 14-28 „
Elbow	„	„	„ 14-21 „
Shoulder	„	„	„ 14-21 „

*Miner's Wrist.*—See Occupation Diseases.

*Sprain Fracture*:

Ankle	„	„	„ 28-56 days.
Wrist	„	„	„ 21-35 „

(iii.) **Dislocation and Subluxation.**—

Hip ...	...	...	... 56 days.
Knee	...	...	... 56 „
Ankle	...	...	... 42 „
Shoulder	...	...	... 42 „
Elbow	...	...	... 42 „
Wrist	...	...	... 42 „
Jaw ...	...	...	... 28 „
Collar-bone	...	...	... 35 „
Pelvis	...	...	... 56 „
Small joints of hand	...	...	... 35 „
Small joints of foot	...	...	... 35 „

(iv.) **Wounds (Uncomplicated).**—After the scar is sound, fourteen to twenty-one days. Where ankylosis or adhesions occur, return to an occupation requiring the free use of the joint will obviously be out of the question. It should be understood, however, that ankylosis of certain joints in good position involves surprisingly little incapacity. For example, a man may go through life without his daily companions knowing that he has an immovable elbow.

(v.) **Detachment of Portions of Cartilage or Bone with or without the Formation of a Loose Body within the Joint: Internal Derangement of the Knee.**—Where the stability of the knee is absolutely essential, safe return to work can only be guaranteed when the loose body has been removed. Three months after the operation may be assigned for resumption of work.

(vi.) **Fracture of the Bones within the Joint.**—Forty-two to eighty-four days. Every case must be judged upon its merits and the nature of the work. (See above, Return to Work—General Considerations.)

### Recurrence.

A joint that has once been subject to dislocation is liable to be put out by comparatively slight violence thereafter. This is best marked in the shoulder and lower jaw.

### Occupation Diseases.

**Miner's Wrist.\***—Miner's wrist is a condition of synovitis or inflammation of the wrist-joint and of the surrounding tendon-sheaths. It is a painful affection, and one easily recognized by the swelling, and by creaking or crepitation to be felt by the observer in the parts where the muscles are put in motion.

The treatment is rest, secured by appropriate compression-bandages, and the duration of the incapacity caused is directly dependent upon the promptitude with which treatment is adopted. If treated at once, it will be a matter of ten days; if neglected, it may drag on for many weeks.

Painful joints (arthralgia) are often seen in printers, painters (arthralgia saturnina), divers, and caisson workers.

Gout, rheumatism, and chronic arthritis are common amongst printers, painters and decorators, porcelain workers (chronic

\* A disease included in the Third Schedule of the Workmen's Compensation Act, 1906.



arthritis of the fingers) washerwomen, tinsmiths, miners, foundry workers, gardeners—in all those, that is, who are exposed to sudden and great changes of temperature (furnace tenders), or those exposed to wet and cold.

### Diagnosis.

The existence of dislocation is usually recognized, but the abnormal position of the parts may be obscured temporarily by a great amount of swelling. In so complicated a joint as the elbow, the exact position and condition of the bones, even with the aid of a radiogram, taken stereoscopically, may be made out with difficulty. Small portions of the upper arm bone may be torn off, or the bone may be broken at the same time. When the break is close to the end of the bone, it is impossible without X rays to diagnose the condition.

An incomplete dislocation, especially of one of the small bones, such as those of the foot (the astragalus), may pass undetected for a time on account of the excessive effusion into the soft parts.

**Congenital Dislocations.**—These call for merely a passing notice. They may be used by the unscrupulous as a means of attracting sympathy and attention, and even obtaining money.

**Dislocation due to Disease (Pathological Dislocations).**—They occur in the course of disease of the joints, and they are not infrequently met with. Thus, in tubercular and rheumatoid joint disease of the hip, the head of the thigh-bone is sometimes displaced from the socket. As a rule the displacement is gradual, not sudden; and it is not usually preceded by injury or violence.

**Acute Inflammation of the Hip-Joint with Dislocation in Adolescents.**—There is, however, a class of cases occurring, especially in adolescents and adults, in which an injury occurs to the top of the thigh-bone (the epiphysis of the femur), and is followed by an acute inflammation of the hip-joint (acute septic arthritis). This results in complete disorganization of the joint, and the hip has been found to be dislocated. Such an occurrence may lay a medical man open to a charge of negligence. As a matter of fact, dislocation will occur in these cases without any special attention being drawn to it.

Matter (pus) forms, it may be painlessly, and distends the case (capsule) of the joint. This is softened by the acute inflammation, so that the head of the bone, not being firmly

held, slips out. Such dislocations have been discovered after death.

### Malingering.

Malingers do not often attempt to simulate the effect of recent joint injuries. They choose rather the late effects, such as stiffness, immobility, and loss of power. Wasting of the limb may arise from disuse, but loss of power can be estimated by electrical tests (see *Electrical Testing*, p. 283), and the degree of stiffness can be ascertained under an anæsthetic. A malingerer will almost invariably refuse to submit himself to either test. If he is kept under observation, especially during sleep, movement or alteration of position may be detected, and the pain he complains of does not, as a rule, keep him awake. In fact, one of the simplest means of estimating the degree of pain is whether it does or does not cause sleeplessness.

Cases of hysterical joint pains are recognized by a number of well-known characteristics, both of the local affection and of the body generally ("Hysterical Stigmata"). A very common ground for claim made by the malingerer is stiffness and pain in the back after a fall when carrying a weight on the back, or when weights fall upon the shoulders or back. Injuries to the bones may be excluded by radiography.

Torn muscles and fasciæ and simple contusions are accompanied by swelling due to effused blood.

Simulation of an arthritis (joint inflammation) is not uncommon in the hysterical or neurasthenic, and the cause assigned is often a trivial injury. As a rule there is an interval before the symptoms come on. Though a resemblance to actual inflammation (arthritis of the joint) may be seen in many particulars, yet there are certain points of difference.

In hysterical cases excessive sensibility—"Hyperæsthesia"—of the skin is well marked, and may be strictly in rings (annular in its distribution—"Stocking Hyperæsthesia"), instead of following the anatomical distribution of the nerves. Though the exact areas of skin supplied by given nerves will vary slightly in each individual, yet those areas are fairly well marked, and the nerves easily identified. The areas usually run in the limbs lengthways. Hysterical hyperæsthesia is often annular or round the arm, and then does not coincide with the anatomical distribution of the nerve.

In some instances where the approach of the surgeon's hand

to examine the part apparently causes an agony of apprehension, and the gentlest touch elicits groans and shrieks of pain, it is often possible, when the patient's attention is diverted, to manipulate the joint freely without protest. If the patient is called upon to use the joint unexpectedly, he often does so with ease.

In hysterical joints contractions are common, and flexion is extreme, or a limb may be held rigidly extended. It may also be noted that the limb can be moved for voluntary acts which are habitual, yet all attempts at passive movements by the surgeon are obstinately resisted.

A false posture may be maintained for a long period without development of the deformities associated therewith when organic mischief is present. It is also noticeable that the false posture is not always that which is best calculated to give relief to the pain which is said to be present. If it is asserted that the parts are paralyzed, advantage may be taken of testing electrically the reaction of the muscles in order to clear up the diagnosis. (See *Electrical Testing*, p. 283.)

The most remarkable contortions are sometimes seen when efforts are made to use hysterical joints. Some of these persons are genuine cases of traumatic neurasthenia; they apparently suffer pain, and they require careful treatment. It is true that the treatment, to be successful, must be approached from a psychological rather than from a physical point of view, and frequently must be dramatic. It is by no means uncommon nowadays for a patient to present himself to a medical man declaring he has had an accident to a joint. There are no objective symptoms of injury, but he complains of great pain and tenderness in one spot. The trouble of undergoing treatment strengthens his belief in the effects of injury.

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*For legal cases of Injury to Joints see CASE GUIDE : Joints.*

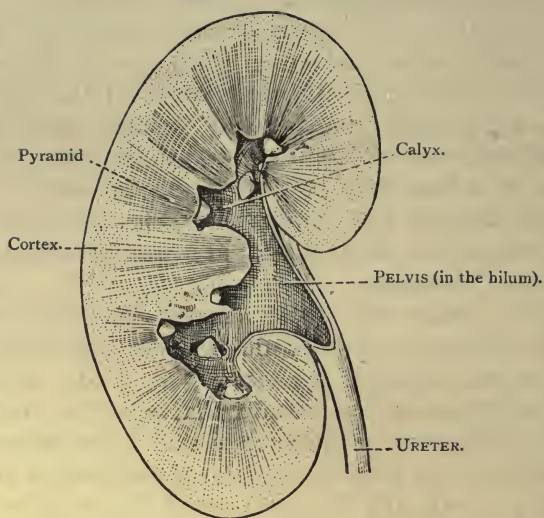


FIG. 128.—KIDNEY, SHOWN DIAGRAMMATICALLY IN SECTION.  
 (From Buchanan's "Anatomy.")

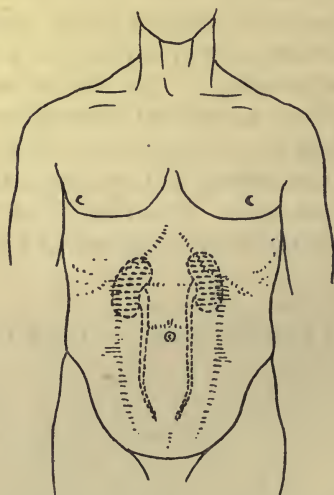


FIG. 129.—PROJECTION OF THE KIDNEYS WITH THEIR DUCTS (URETERS), TO INDICATE THE POSITION THEY OCCUPY IN THE BODY.

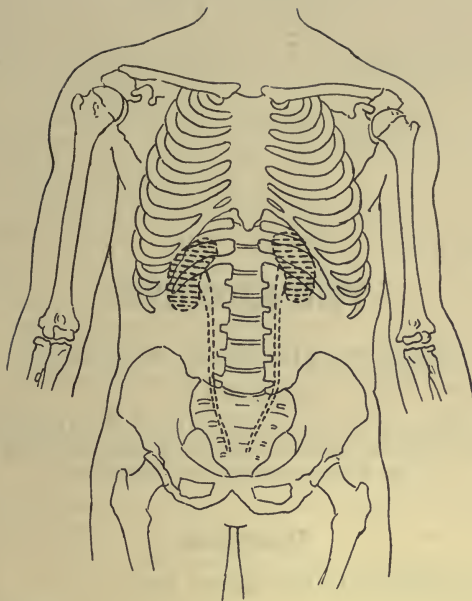


FIG. 130.—PROJECTION OF THE BONES OF THE TRUNK AND OF THE KIDNEYS WITH THEIR DUCTS (URETERS), SEEN FROM THE FRONT.

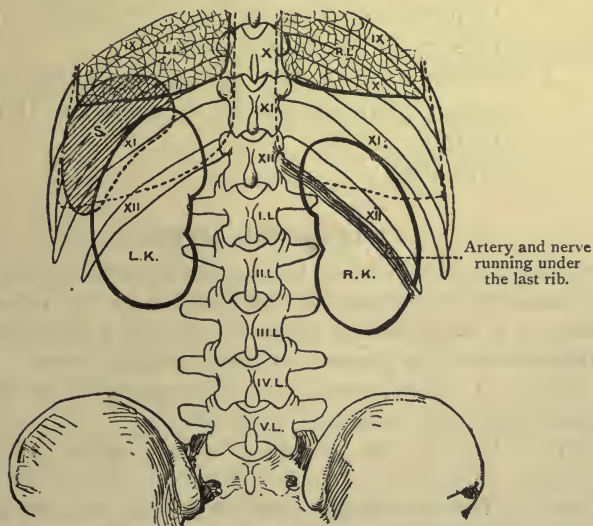


FIG. 131.—DIAGRAM SHOWING THE POSITION OF THE KIDNEYS AND SPLEEN FROM BEHIND.

All the muscles, etc., are removed, and only the bones of the last few ribs, numbered IX to XII, remain. IX to XII, the last four ribs; R.L. and L.L., right and left lungs; R.K. and L.K., right and left kidneys (note that the left is higher than the right); S, Spleen; I.L. to V.L., the five lumbar vertebrae.

(From Buchanan's "Anatomy.")

# THE KIDNEYS.

By J. W. THOMSON WALKER,

M.B., F.R.C.S.,

Surgeon in charge of Out-Patients at the North-West London Hospital and Hampstead General Hospital; Assistant-Surgeon at St. Peter's Hospital for Stone, etc.

## Head-note.

THE dangers of injury to the kidney are—

1. Shock.
2. Hæmorrhage (bleeding).
3. Arrest of the production of urine by the kidneys (suppression of urine), and consequent retention of poisons in the body (uræmia.)
4. Inflammation of the kidney or neighbouring parts, which may go on to suppuration (formation of matter).
5. Peritonitis.

## Technical Terms.

*Abscess of the Kidney.*—The formation of matter within the kidney.

*Albumin.*—A constituent of the blood found in urine in kidney disease; it is not present in the urine of healthy individuals.

*Albuminuria.*—The presence of albumin in the urine.

*Calculus.*—A stone formed of various materials in the kidney—oxalate of lime, uric acid, etc. [Fig. 16.]

*Calyx.*—One of the branches of the pelvis of the kidney. [Fig. 128.]

*Capsule.*—The thin skin or sheath which encloses the kidney.

*Colic (Renal).*—An attack of violent pain commencing in the region of the kidney, and shooting downwards, sometimes into the testicle of the same side, caused by the presence of some obstructing body in the kidney duct, (ureter).

*Extravasation.*—Escape of urine from its normal channels or reservoirs into the tissues of the body.

*Floating Kidney (or Movable Kidney).*—A kidney which is abnormally movable in the abdominal cavity.

*Hæmatūria.*—The mixture of blood with the urine.

*Hæmoglobīnūria.*—The mixture of the colouring matter (hæmoglobin) of the blood with the urine.

*Hilum.*—The notch of the kidney. [Fig. 128.]

*Hýdrōnēphrōsis.*—Distension of the kidney from blocking of the duct (ureter).

*Movable Kidney.*—See Floating Kidney.

*Nēphritis.*—Inflammation of the kidney.

*Obstruction (Urinary).*—The blocking of the outflow of the urine, which is secreted as usual, but cannot escape through its natural channels. (See, *per contra*, Suppression.)

*Pelvis.*—The funnel-shaped expansion of the upper end of the duct of the kidney. It called the “pelvis of the kidney,” or the “renal pelvis,” and branches somewhat like the finger of a glove in the substance of the kidney. [Fig. 128.]

*Pērīnēphritis.*—Inflammation of the tissues around the kidney.

*Pērīnēphritic Abscess.*—The formation of a collection of matter around the kidney.

*Pērītōnēum.*—The lining of the abdomen. (See Peritoneum, p. 612.)

*Pērītōnītis.*—Inflammation of the peritoneum.

*Pōlyūria.*—Passing of an excessive quantity of urine.

*Pýōnēphrōsis.*—Distension of the kidney and its pelvis from the accumulation of matter. It is called “calculous pyonephrosis” when kidney stone (calculus) is the cause of the disease.

*Suppression of Urine.*—Passing of small quantity or even no urine, owing to the kidneys not excreting it. (See Obstruction.)

*Suppurative Nēphritis.*—The formation of matter in the substance of the kidney.

*Tube-Casts.*—Microscopic moulds or casts of the urine tubules of the kidney. These casts are found in the urine in kidney disease.

*Tubūles of the Kidney.*—The minute urine ducts of the kidney which open into the pelvis.

*Ūrēmia.*—The accumulation of poisons in the blood, which are normally removed in the urine.

*Ūrēter.*—The tube which conducts the urine from the kidney to the bladder. [Figs. 90, 127, 128, 129.]

*Urīne.*—The secretion of the kidneys. It is mainly an excretion of waste products dissolved in water. It contains about 2 per cent. of nitrogenous matters in various forms, such as urates, etc. In disease the urine contains various other substances, such as uric acid (gout), albumin and blood (kidney disease), sugar (diabetes), bile (jaundice), indigo (intestinal disease).

### Anatomy.

There are two kidneys in the normal subject. They lie on each side of the spine, at the back of the abdomen, behind the intestines. If the body is viewed from the front, the position of the kidneys in relation to the surface is as follows: The lower end of each kidney is just above a horizontal line drawn at the level of the navel. [Figs. 129, 130.] Each kidney is 4 inches long, and lies with its long axis lengthwise in the body, and is about 2 inches from the middle line. [Fig. 127.] Viewed from the back, the kidneys lie beneath the eleventh and twelfth ribs, a small part of the lower end of each projecting below the twelfth rib. [Fig. 130.] They are nearest the surface of the back of the body, and are most liable to be injured by violence applied to the back or to the side of the loin.

The kidney is shaped like a bean. It lies on the muscles at the back of the abdomen; the hollow part, or notch (the hilum), lies towards the spine, and the convex or rounded part away from the spine. The kidney is covered by a very thin sheath (the capsule), and lies embedded in a mass of fat. The front of the kidney is covered by the intestines, and in part by the lining of the abdominal cavity, or peritoneum. This lining (the peritoneum) covers all the organs of the abdomen, but in varying extent. Some organs are almost completely enfolded. The kidneys and their urine duct (the ureter) lie behind this covering, and are only partly covered by it in front.

At the notch of the kidney the bloodvessels enter and leave. Here also the minute tubes (renal tubules) which collect the urine within the kidney open into the expanded upper portion of the duct or drain of the kidney. This expanded part is called the "pelvis of the kidney," and the duct which drains away the urine is the ureter. [Fig. 128.] The ureter passes downwards on the muscles at the back of the abdomen, and, as has been said, lies behind the peritoneum, or lining membrane, of the abdomen. Owing to this position of the kidneys and ureter behind the peritoneum, they can be removed from behind without opening the peritoneal cavity.

Each ureter is 12 inches in length, is about the thickness of a crow-quill, and opens into the bladder by a minute aperture. The two openings of the ureters into the bladder are an inch apart.

The wall of this duct is composed of fine muscle fibres which



contract from above downwards, and drive the urine down from the pelvis of the kidney into the bladder. It is the contraction of these muscles to expel an obstruction—*e.g.*, a small stone or blood-clot—which causes the acutely painful condition known as “renal colic.”

### Consequences of Accident.

- (i.) Contusion and rupture without external wound.
  - (a) Limited to the kidney—*i.e.*, the peritoneum and other parts not involved.
  - (b) Involving other parts.
    - ( $\alpha$ ) The peritoneum.
    - ( $\beta$ ) Abdominal organs.
    - ( $\gamma$ ) Ribs or spine.
- (ii.) Wounds communicating with the external surface the body.
- (iii.) Displacement (movable or floating kidney).

#### (i.) Contusion and Rupture without External Wound.—

(a) *Limited to the Kidney.*—Injury to the kidney without an external wound, and which does not involve the peritoneal covering, varies very much in degree. There may be a small tear of the kidney substance, without rupture of the kidney sheath (capsule), causing a small or large escape of blood under the capsule. This may become absorbed gradually without further trouble, or may remain as a cyst or small tumour filled with fluid, or, if micro-organisms gain entrance, an abscess may eventually form.

More serious injuries may tear the capsule and produce deep lacerations into the kidney substance. A large blood-tumour may then be formed. If the tear of the kidney does not extend as deeply as the notch, and open into the pelvis or one of its branches, the blood will not escape into the urine, and the urine will not escape into the tissues surrounding the kidney. If the pelvis or one of its branches is torn, blood will appear in the urine. The blood may clot in the bladder, which will be unable to expel this large mass, and great distress is thus caused. If urine is poured out into the tissues surrounding the kidney, it mixes with the blood which has already escaped, and forms a large swelling indistinguishable from that formed by blood alone. This frequently breaks down into an abscess. If there has been severe injury to the kidney, the damage may be so extensive that it is split in two or more pieces, or it

may be completely crushed into a pulp. Death may be caused in a few minutes or after some hours by shock or hæmorrhage, or may take place after some days or weeks from the formation of an abscess causing blood-poisoning.

(b) *Involving other Parts.*—(a) *The Peritoneum.*—The lining membrane of the abdominal cavity covers a part of the front of the kidney, and it may be torn by the violence that ruptures the kidney. This more frequently happens in children than in adults. This is a very serious complication, for blood issuing from the torn vessels of the kidney escapes into the abdominal cavity. A large quantity of blood may thus be rapidly lost, and death from internal hæmorrhage ensue. If the loss of blood is not large and the patient survives, there is the further danger of urine escaping from the torn pelvis of the kidney into the peritoneal cavity and setting up peritonitis, which is likely to be fatal. (See Abdomen, p. 40.)

(β) *Abdominal Organs.*—The same injury which affects the kidney, especially if the force be directed from the front, is almost certain to damage other of the abdominal organs. (For these, see Abdomen, Intestines, Liver, Spleen, Stomach, etc.)

(γ) *Ribs or Spine.*—Fracture of the ribs is very common, and the kidney may be injured by one of two ways: either by the same violence which breaks the ribs, or the ends of the broken ribs may themselves tear one of the kidneys.

Injury to the spine is a most serious complication of ruptured kidney, on account of the injury to the spinal nerve cord. (See Spinal Cord.)

(ii.) **Wounds communicating with the External Surface of the Body.**—Injury of the kidney with external wound is caused under such circumstances as gunshot injuries, stabs, falls on sharp spikes, and they are more dangerous from the risk of the entry of dirt and from bleeding and escape of urine.

The same complications and results described as occurring in rupture of the kidney without external wound may attend an injury of the kidney which is caused by stabs or gunshot.

Blood and urine may escape from the wounded kidney, and either collect round the kidney within the body or escape through the wound.

If the wound extend as deeply as the peritoneum, tearing it, then blood and urine will escape into the general abdominal cavity. If the wound be very extensive, the entire kidney may escape into the wound, and may lie partly outside the body.

The danger from inflammation after these wounds is very

serious; dirt, particles of clothes, or fragments of the penetrating substance, are all apt to lodge in the wound.

(iii.) **Displacement (Movable or Floating Kidney).**—A blow which is insufficient to cause rupture of the kidney may loosen the kidney from its supports, and cause it to be unduly movable. The same accident may result from lifting a heavy weight, or jumping off a height, or from a sudden bending. A movable kidney may cause attacks of renal colic and hæmaturia by twisting or kinking the ureter, and twisting or dragging on the bloodvessels. The ureter may in this way be kinked so that the urine accumulates in the pelvis of the kidney, and gradually distends the kidney until it becomes a thin-walled sac, containing watery urine (hydronephrosis). A movable kidney is affected by muscular exertion, and the symptoms are improved by rest. It is much more frequently found in women than in men, and is very rarely indeed the result of an accident.

### Disease.

#### 1. Produced by the Accident.—

Suppression of urine (uræmia).

Peritonitis.

Perirenal abscess (abscess round the kidney).

Tuberculosis.

Stone (calculus).

Obstruction to the ureter (hydronephrosis).

*Suppression of Urine (Uræmia).*—Where both kidneys are seriously injured, or one kidney is diseased and the second kidney is injured, suppression of urine may follow.

The poisons which should be removed in the urine collect in the blood, and uræmia results. The patient suffers from thirst; his tongue is dry and red, and later covered with a brown coat. There is loss of appetite, hiccough, and vomiting. He complains of headache, and becomes increasingly drowsy; there is frequently twitching of the muscles of the arms and legs, and occasionally convulsions. After some days coma supervenes, and death takes place.

*Peritonitis.*—Inflammation of the peritoneum may be confined to the part which immediately covers the kidney (local peritonitis), or the inflammation may spread throughout the whole abdominal cavity (general peritonitis). The inflammatory exudation from local peritonitis may unite the coils of

intestines lying immediately over the damaged kidney, so that the blood and urine which have escaped are sealed off from the rest of the abdominal cavity. If, however, the peritoneum has been ruptured and the pelvis of the kidney torn, it is more likely that urine will escape into the cavity of the abdomen and general peritonitis be set up.

*Perirenal Abscess (Abscess round the Kidney).*—An accumulation of blood and urine around the kidney may form an abscess.

The symptoms frequently commence with cold shivers (rigors), and the temperature suddenly rises. There is local pain and tenderness.

*Tuberculosis.*—Very rarely tuberculosis may follow an injury owing to the bacilli growing in the damaged tissues; but this need not be considered in prognosis.

*Stone (Calculus).*—A stone may occasionally form around a small piece of blood-clot in the pelvis of the kidney.

*Obstruction to the Ureter (Hydronephrosis).*—If the duct of the kidney (ureter) is injured, but its walls are not ruptured, the internal wound on healing may contract, so that its canal is narrowed or completely occluded. The urine, being thus prevented from draining away, collects in the kidney and distends it. In time, owing to the pressure of the retained urine, the kidney becomes enormously distended, and a large bag is formed which is filled with watery urine. This is called “hydronephrosis.”

The same result may be produced by blocking of the duct by a blood-clot. If inflammation follows the accident, the kidney may be distended with matter (pus) and urine, forming a pyonephrosis.

**2. Existing before the Accident and aggravating its Effects.**—The presence of disease of the kidney previous to the accident will increase the danger of the injury.

Diseases which destroy the substance of the kidney, such as stone, tuberculosis, chronic nephritis, will increase the risk of suppression of urine.

A kidney which is the seat of stone is more readily injured than a healthy kidney, and the resulting rupture will be more extensive. Thus the danger of tearing of the peritoneum will be increased. Hæmorrhage is more easily produced.

Injury to kidneys affected by tuberculosis or chronic nephritis may increase the activity and extent of the pre-existing disease.

Though these diseases are ultimately fatal in themselves, an injury to a diseased kidney may accelerate the advent of death.

It may happen that only one kidney develops, while the other remains small and useless from birth. In such a case an injury to the solitary kidney would be a much more serious matter than if both kidneys were present. In a similar manner, one kidney may be destroyed by disease which becomes quiescent. An injury to the remaining kidney may then cause death where there would have been no fatal result had there been two healthy organs.

On the other hand, even an injury to a diseased kidney may have its advantages, and be the means of bringing about a cure by drawing attention to the disease. The writer has met with a case in which a slight blow on the loin was followed by severe hæmaturia, and examination revealed a stone in the kidney, which was removed by operation. In another case the writer operated on a young man who gave the following history: He had been working at a foundry, and was struck in the loin by a piece of iron. The wound opened a large collection of matter which had formed in the kidney as the result of the presence of a stone. The disease had not been suspected before the accident. The patient was eventually cured by operation.

**3. Disease of the Kidney aggravated by Injury elsewhere in the Body.**—It has been claimed that injury to the body not directly involving the kidneys has produced an aggravation in the progress of the disease (chronic interstitial nephritis) from which the kidneys were already suffering. The claim was upheld by the court, but each case of the kind should be carefully proven, and no one case accepted as a precedent.

### Operation.

Operation is necessary for injury (*a*) without external wound, or (*b*) with external wound, under the following conditions: Hæmorrhage (bleeding); acute inflammation; suppression of urine; escape of urine around the kidney or ureter; abscess; hydronephrosis; pyonephrosis; tuberculosis; calculus.

(i.) **Contusions and Rupture without External Wound.**—If after a few hours the patient does not rally from the shock of the accident, and if there are signs of internal hæmorrhage, immediate operation will be called for. Even if the patient has rallied from the shock of the accident, operation will be required if there is continued hæmorrhage, which may either show itself in the urine, or collect in the tissues around the kidney, or escape into the cavity of the abdomen. Suppression of urine persisting

after the shock has passed off, or signs of suppuration (the formation of matter), call for operation. Should urine, blood, or matter, collect round the kidney, an operation will be required.

The secondary results of injuries to the kidney mentioned above may also necessitate operation (hydronephrosis, pyonephrosis, tuberculosis, calculus).

(ii.) **Wounds communicating with External Parts.**—Operation is necessary in all cases of injury to the kidney with external wound, in order to remove dirt, portions of clothing, etc., which may have entered the wound.

The external wound is enlarged, and then the condition of the injured organ is examined, or the wound is plugged with gauze or some such material, or portions or the whole of the kidney is removed, or the main vessels of the kidney are tied. The nature of the operation will vary with the conditions necessitating its performance. The immediate operation for hæmorrhage consists in exposing the injured kidney as rapidly as possible, and then stopping the escape of blood either by the removal of portions or the whole of the kidney or by tying the main vessels of the kidney. As the kidney lies behind the peritoneum, it is not usually necessary to open the peritoneal abdominal cavity to operate on the kidney, which can be reached from behind the peritoneum. It is necessary to open the abdominal cavity only where the peritoneum has been ruptured and hæmorrhage into the cavity is going on, or where urine has escaped into the cavity. Opening of the cavity may be required in order to explore the extent of the injury to the other abdominal organs.

The risks which the patient runs are those of the effect of the accident rather than of the operation. Where operation is necessary, the patient is already in grave danger of his life from the effects of the accident, and the operation is undertaken with a view to save life. In 1896 the deaths in uncomplicated cases of injury to the kidneys which were not operated upon amounted to 34·5 per cent., the cases operated upon to 36·4 per cent. The cases operated upon were the most severe.

(iii.) **Displacement of the Kidney, and Operations for Other Complications and Diseases.**—The operation which may be required for secondary conditions are very various, and may comprise cutting into and draining the kidney (nephrotomy), removal of the kidney (nephrectomy), fixation of a floating kidney (nephropexy).

### Cure.

A patient may completely recover from a rupture of the kidney. The time taken before recovery is complete will vary with the extent of the injury and the occurrence of complications. Where the rupture of the kidney is not extensive, and the only sign has been blood in the urine (hæmaturia), the patient will be confined to bed for a fortnight or three weeks, and after that, if blood be absent from the urine and there are no local signs of disease, he may be allowed to get about.

A more severe lesion of the kidney which has not been submitted to operation will require a longer rest in bed. The patient should be confined to bed for at least a fortnight after the hæmorrhage has ceased. But since the bleeding may recur after the blood has once disappeared from the urine, he may have to return to bed, and so the total stay in bed may extend to six weeks, or even longer. Where immediately on an injury an operation has been performed, about six weeks or two months may be required for convalescence. Where the complications which sometimes arise after the accident have to be treated by an operation, the illness will be correspondingly prolonged.

### Return to Work.

The time for return to light or heavy work will, again, vary with the severity of the injury, and whether or not an operation has been required.

A fortnight to a month may be allowed for convalescence after the patient has been passed as surgically sound, and after this time light work may be undertaken. Heavy manual labour, such as the lifting of weights, would not be safe for six weeks to three months after he is surgically cured.

### Recurrence.

When the patient has been cured, there is no danger of recurrence of the consequences of the accident. (See above, Cure.) There is still the remote danger of the secondary effects that have been mentioned, but this is slight.

### Occupation Diseases.

**Chronic Kidney Disease.**—Chronic interstitial nephritis frequently occurs in workmen who handle lead or substances containing lead (painters, glaziers, and plumbers). Injury to the

kidneys is more serious where chronic nephritis is present. Other poisons, such as alcohol, also produce chronic nephritis. Thus, publicans, draymen, cabmen, and others whom opportunity or habit predisposes to excessive indulgence in alcohol, are specially bad subjects for injuries to the kidneys.

### Diagnosis.

**Chronic Kidney Disease.**—Of diseases existing before the accident, chronic interstitial nephritis will be suspected if the occupation of the patient has necessitated contact with lead in some form. The following symptoms may, some or all, be or have been present: Intestinal colic, anæmia, a blue line at the edge of the gums, chronic inflammation of the nerve of the eye-ball (optic neuritis), thickening of the arteries, and enlargement of the heart (hypertrophy). The quantity of urine produced is greatly increased, and this will cause the patient to pass water more frequently during the day, and to rise at night. The urine is watery, and the quantity of the solid constituents is diminished.

**Stone.**—The principal symptoms of stone in the kidney are as follows: Pain in the back, with occasional attacks of severe pain shooting down into the testicle (renal colic); blood in the urine (hæmaturia); matter in the urine (pyuria); and sometimes enlargement of the kidney. Occasionally a small stone has been passed at some previous time. Any one or all of these symptoms may be absent, in spite of a stone being present, if it is causing no irritation (quiescent calculus).

The diagnosis of a stone having pre-existed in a case of rupture of the kidney will depend upon the history of these symptoms.

A stone would be discovered in operating, but it is just possible that a small stone might escape observation. The X rays will show the presence of a stone.

In the case where a stone was actually discovered a long time after a rupture of the kidney, the diagnosis of its pre-existence might prove difficult, and would depend upon the history of symptoms previous to the accident, and upon the size and composition of the stone, and upon the lapse of time since the operation. Very large stones may take many years to develop. Some of them discovered in adults of forty or fifty have existed since childhood. A very large stone or a collection of stones is less likely to give rise to pain than a small stone that is movable. The time taken for the formation of a stone may be suspected



from its composition. Roughly speaking, a small stone composed of oxalate of lime will take years to form; one of uric acid, months; while one of phosphate of lime may be formed in a few weeks.

The presence of stone in the kidney that is uninjured, as well as in the injured organ, would point to a formation of stone apart from the accident.

**Tuberculosis.**—Tuberculosis of the kidney gives symptoms similar to those of stone, and in addition there is frequently tuberculous disease of the bladder. The bacillus of tuberculosis is present in the urine. Tuberculosis of the kidney may exist without giving rise to symptoms which draw attention to its presence. The question which might arise in regard to this disease would be whether, in the event of discovery of tuberculosis of the kidney some time after the accident, the tuberculosis was due to the accident.

The existence of symptoms of tuberculosis of the kidney or of the bladder previous to the accident, and the discovery soon after the accident of widespread tuberculous disease of one or both kidneys, or of the kidney and bladder, would show that the disease had pre-existed. The tuberculous process is a slowly progressive one, and the destruction of a kidney by this means takes several years.

**Floating Kidney.**—A floating kidney may give rise to no symptoms, and its presence may be unsuspected by the individual. An accident may lead to its discovery.

The symptoms of movable kidney are of two kinds—viz., those referred to the kidney itself, and those which are secondary and affect other parts.

The symptoms referred to the kidney itself are pain and attacks of renal colic, caused or aggravated by movement. Occasionally there is blood in the urine, and sometimes albuminuria. Intermittent enlargement of the kidney (hydro-nephrosis) from blocking of the duct is another symptom.

The symptoms which are secondary to undue mobility of the kidney are: 1. Nervous symptoms. 2. Digestive symptoms.

The pre-existence of such symptoms is the basis on which the diagnosis rests. The injuries which lead to undue mobility of the kidney are usually slight in character.

Women suffer more frequently than men from floating kidney. The causes of movable kidney are not always known. Even where the undue mobility is apparently due to the accident, such pre-existing factors as the shallowness of the bed of

the kidney in women, and the effect of child-bearing, may really have caused the trouble; for, apart from injuries, the kidney may become unduly movable from frequent pregnancies, from rapid diminution in the fat surrounding the organ, and from other causes.

**Blood in the Urine: Acute Nephritis.**—Blood occurs in the urine from many causes other than accident, from which it must be diagnosed. A little care should be sufficient to avoid any mistake in diagnosis.

#### **Malingering.**

(a) Injury to the kidney which leads to rupture of the organ is of so serious a nature that the patient will of necessity employ the services of a medical man, so that the proof of the accident can be obtained from him. The doctor's description of the symptoms, the presence of scars or of other signs of the accident—viz., evidence obtained by X rays of repair of fractured ribs or other bones—are all important points in the proof of an accident.

(b) After the patient is apparently well, he may complain of pain in the kidney. Such pain, even if present, is not likely to incapacitate him from work.

(c) Paroxysmal hæmoglobinuria, which produces intermittent and irregular discharge of blood in the urine, has been used as a means of fraud.

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*For legal cases of Injury to the Kidney see CASE GUIDE: Kidney.*

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### **KNEE.**

*See* JOINTS, BURSÆ—HOUSEMAID'S AND BEAT KNEE.

### **LARYNX.**

*See* THROAT.

### **LEAD.**

*See* POISONS.

### **LIGAMENTS.**

*See* JOINTS.

### **LIGHTNING.**

*See* ELECTRICAL INJURIES.

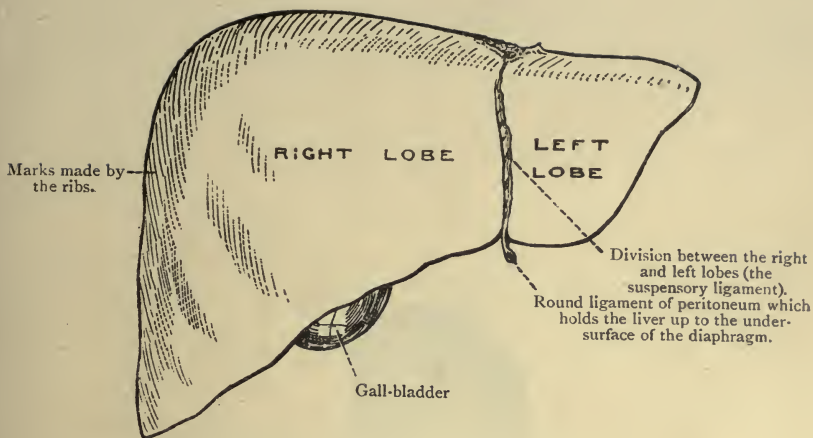


FIG. 132.—LIVER REMOVED AND SEEN FROM ABOVE AND IN FRONT.  
(From Buchanan's "Anatomy.")

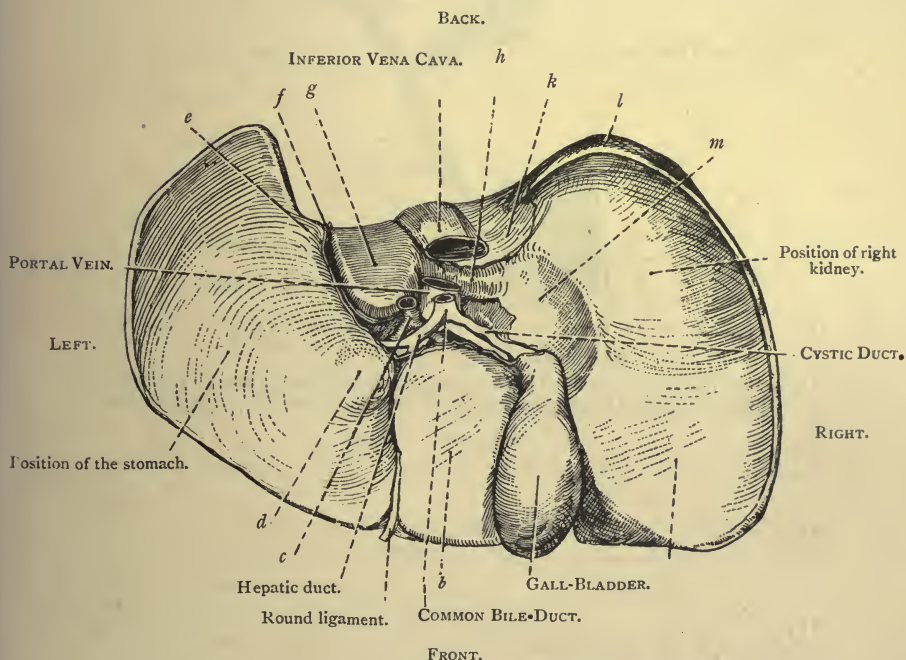


FIG. 133.—UNDER SURFACE OF THE LIVER, SHOWING THE POSITION OF SOME OF THE OTHER ORGANS IN CONTACT WITH IT:

*a* to *m* indicate areas either named, or in relationship with organs other than those named here.

(From Buchanan's "Anatomy.")

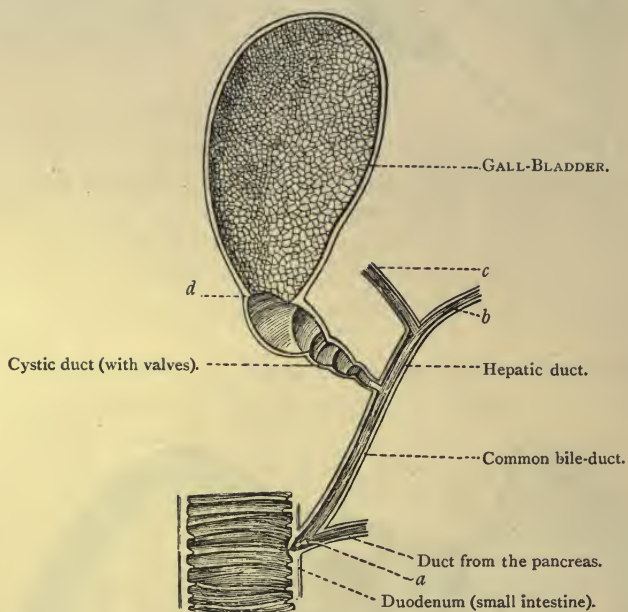


FIG. 134.—A SMALL PIECE OF THE INTESTINE WITH THE BILE-DUCT AND PANCREATIC DUCTS OPENING INTO IT.

Above, the bile-duct continues back into the gall-bladder by the cystic duct, or into the liver by the hepatic duct. The whole is shown in section.

(From Buchanan's "Anatomy.")

# THE LIVER.

By JAMES SHERREN,

F.R.C.S.,

Surgeon to the London Hospital ; Surgeon to the Poplar Hospital  
for Accidents ; late Erasmus Wilson Lecturer,  
Royal College of Surgeons.

## Head-note.

THE danger of injuries to the liver arises from bleeding into the liver itself or into the abdominal cavity. If the injury affect the gall-bladder or biliary passages, leakage of their contents into the abdomen (peritoneal cavity) may lead to peritonitis and death.

## Technical Terms.

*Bile-Duct, Common.*—See Duct.

*Dīāphrāgm.*—The muscular partition separating the cavity of the chest from the cavity of the abdomen. It is a most important breathing muscle.

*Duct.*—A natural pipe or tube leading from an organ.

*Duct, Common Bile.*—The pipe which conveys the bile into the intestines. [Figs. 132, 133, 149.]

*Duct, Cystic.*—The pipe from the gall-bladder to the common bile-duct. [Figs. 132, 133, 134.]

*Duct, Hepatic.*—The pipe from the liver to the common bile-duct. [Figs. 133, 134.]

*Fistūla.*—An abnormal communication between a hollow organ and the surface of the skin or between two hollow organs. A fistula will usually close if the ordinary duct is freely open, but will remain unclosed if there is obstruction in this duct.

*Fistūla, Biliary.*—An opening on the surface of the skin which discharges bile. It is usually an abnormal communication with the gall-bladder which once made persists in consequence of some obstruction to the outflow of bile through the natural channel (the common bile-duct). It may be a communication set up between some of the small bile-ducts in the liver and the surface of the body.

*Gall-Bladder*.—A pear-shaped sac attached to the under surface of the liver. It is provided with a duct which joins with the bile-duct from the liver (hepatic duct) to form the common bile-duct. It is said to serve as a reservoir for bile during the intervals of digestion. As the result of disease it often contains stones (biliary calculi). [Figs. 132, 133, 134, 149.]

*Hepatic Duct*.—See Duct.

*Hepatic Vein*.—A vein conveying blood away from the liver. The hepatic veins open by several large openings into a large vein (the inferior vena cava) leading to the heart.

*Ligament (in the Abdomen)*.—A fold of peritoneum attached to a solid organ.

*Omentum*.—A fold of peritoneum connected with the stomach. [Fig. 172.]

*Pancreas (Sweetbread)*.—A solid organ situated at the back of the belly just above the level of the navel. It manufactures digestive fluid, which is poured out into the intestine at the same spot as the bile. [Fig. 149.]

*Peritoneum*.—The smooth membrane lining the abdominal cavity and covering the contained organs. (See Peritoneum.)

*Portal Vein*.—A large vein which collects the blood, laden with the products of digestion, from the stomach and intestines, and takes it to the liver. It enters the liver at a depression (portal fissure) on its under surface. [Fig. 133.]

*Pleurisy*.—Inflammation of the membrane (pleura) lining the cavity of the chest and covering the lung.

*Pulmonary Embolism*.—The lodgment of a foreign body (an embolus) in one of the arteries of the lungs, to which it was carried in the blood-stream. Such an embolus is usually composed of a particle of blood-clot, and in the case of accidents involving the liver usually comes from the hepatic veins.

*Vena Cava, Inferior*.—The great vein in the abdomen made up of the veins returning the blood from the lower limbs. It is joined by the hepatic vein, which contains all the blood from the intestinal canal after it has passed through the liver. [Fig. 133.]

### Anatomy.

The liver is a solid organ weighing from 40 to 60 ounces. It is situated chiefly in the right upper portion of the abdomen, immediately below the diaphragm and under cover of the lower ribs. A thin part of it reaches across the middle line to the left almost as far as the line of the nipple. [Figs. 132, 133.]

The liver is almost completely covered by peritoneum, which passage from the abdominal wall to the liver forms folds,

called "ligaments." At its lower surface, where the portal vein enters and the bile-ducts leave, the peritoneum passes in a fold to the stomach, forming the small (gastro-hepatic) omentum. The portal vein brings the blood containing the products of digestion from the stomach and intestines to the liver. This blood after passing through the liver leaves by the hepatic veins.

The liver is very friable, and when injured bleeds readily from the open mouths of its veins, which continue bleeding on account of their being held open by the attachment of their walls to the substance of the liver.

From the under surface of the liver the bile leaves the liver in tubes (the right and left hepatic ducts). These afterwards unite to form one tube (the common hepatic duct). [Fig. 133.]

The gall-bladder is a pear-shaped bag situated on the under surface of the liver. Its duct (the cystic duct) joins with the hepatic duct to form the common bile-duct, and runs downwards, and opens 3 or 4 inches from the stomach into the first part of the small intestine (duodenum) in company with the duct from the pancreas. [Figs. 133, 149.]

### Consequences of Accident.

As the result of violence applied to the abdomen, the liver may suffer from—

- (i.) Contusion.
- (ii.) Rupture.
- (iii.) Wound.

(i.) A **Contusion** of the liver results in the escape of blood into its substance. This is usually recovered from spontaneously, but the blood may become infected by microbes and lead to the formation of an abscess of the liver. The abscess may invade the cavity of the chest or cause peritonitis.

A clotting of the blood may take place in the hepatic veins as the result of injury. If a fragment of this clot becomes displaced, it may cause death by blocking one of the main arteries of the lungs (pulmonary embolism).

(ii.) **Rupture** of the liver is rare, but the liver is the solid organ which is most often ruptured. The rupture results from direct injury (crushes or blows) over the right upper part of the abdomen or right lower ribs, and may be associated with fractured ribs and complicated by an injury to the lung or pleura.

In most cases, the blood which escapes from the liver as the result of its rupture passes into the abdominal cavity. Death may ensue in a few minutes, or enough time may elapse to allow an operation. In a few cases the back or upper surface of the liver only is injured; in these cases the escaped blood may collect between the liver and diaphragm.

The gall-bladder and biliary passages are rarely ruptured alone. Their rupture may lead to the escape of their contents into the abdominal cavity, and then death results from general inflammation of the lining (diffuse peritonitis) unless operation is carried out early.

(iii.) **Wounds** of the liver and biliary passages rarely happen to those occupied in civil life. The liver, together with the diaphragm, is sometimes wounded by the fractured end of a rib.

### Disease.

#### I. Produced by the Accident.—

- (a) Abscess of the liver.
- (b) Abscesses of the liver (multiple abscesses).
- (c) Abscess of the abdomen (subdiaphragmatic and abdominal).
- (d) Biliary fistula.
- (e) Peritonitis, local or general.
- (f) Pulmonary embolism.
- (g) Pleurisy.

(a) **Abscess of the Liver** may result from infection of a collection of blood in the liver, or from infection following on an injury to the bile-passages. In this latter case the abscesses will be numerous.

(b) **Abscesses of the Liver (Multiple Abscesses)** may result from infections reaching the organ from the portal vein, due to a collection of matter in the abdomen, from accident or disease, and consequent spread to the veins which drain into the liver. Multiple abscesses of the liver are rare, but occur sometimes after appendicitis. They are almost invariably fatal. (See Appendix, p. 102.)

(c) **Abscess of the Abdomen** may result from the peritonitis, or from infection of blood escaped into the abdominal cavity. Sometimes an abscess forms between the liver and diaphragm (a subdiaphragmatic abscess).

(d) **Biliary Fistula** will result from injury if a communication



is thereby formed between the biliary passages and the skin, especially if there is obstruction to the natural outlet of bile into the intestines.

(e) **Peritonitis, Local or General**, may result from injury to the biliary passages, and in these is usually generalized or diffuse, and leads to death. It may be set up by infection of the blood that has escaped as the result of injury to the liver. It more commonly occurs from infection spread directly from inflammation of the liver or gall-bladder, without there being any accident. (See Diagnosis.)

A local peritonitis may lead to the formation of adhesions, causing pain or interference with the functions of the stomach, which is placed close to the liver.

(f) **Pulmonary Embolism**.—After an accident or disease a clot of blood is formed in the veins of the liver; this is then displaced into the circulation, and as the veins, uniting with each other, form wider channels as they approach the heart, there is room for the clot to flow freely through the heart into the lungs. The vessels here become smaller with each branching, and the clot is caught at last, producing a condition known as “pulmonary embolism.” This is often fatal. (See above, Contusion.)

(g) **Pleurisy** may result from the direct spread of inflammation through the diaphragm, from an abscess of the liver, or from a subdiaphragmatic abscess.

2. **Existing before the Accident and aggravating its Effects**.—**Enlargement of the Liver** is common as the result of alcohol, heart disease, fatty degeneration, lardaceous disease, etc., and will predispose to rupture, as the liver is more exposed, and protrudes below the ribs, which usually cover it.

**Disease of the Gall-Bladder**.—Distension of the gall-bladder, usually caused by gall-stones or cancer, will predispose to its rupture, in consequence of an injury.

### Operation.

In all ruptures or wounds of the liver or biliary passages operation is necessary. The operation consists in bringing the rent together as much as possible, and plugging it to stop the bleeding. The liver is very friable, and it is difficult to tie stitches firmly enough to stop bleeding. In cases in which the biliary passages are involved, the operation consists in closing the rent and in cleansing the abdominal cavity.

The death-rate of all operations for injuries in this region is high.

**Abscess of the Liver.**—When the abscess of the liver is solitary and due to infection of a blood-clot, the operation of opening and draining gives a good hope of cure. But as this usually has to be done through the cavity of the chest, it carries with it especial danger. It is often very difficult to localize the abscess. When several abscesses are present as the result of infection from the biliary passages or portal vein, then the outlook is almost hopeless, and operation can be of little or no avail.

**Biliary Fistula.**—Here operation is necessary. It consists in either removing the obstruction to the flow of bile through the natural channels, or, if this is impossible, in doing a short-circuiting operation.

#### Cure.

This will depend on several factors. The rent in the liver may be sewn up and the patient's life be saved, yet he may die later from pulmonary embolism. Or as the result of the loss of blood he may be partially or permanently incapacitated. After an operation for injury to the bile-passages the patient may recover, yet may have a biliary fistula. He may suffer pain and discomfort from interference with the functions of the stomach as the result of adhesions. (See Abdomen, p. 46.)

#### Return to Work.

After an uncomplicated operation for an injury of the biliary passages, any form of work may be resumed in about three months. But, unfortunately, most of these cases are complicated, and then the patient may be incapable of performing any but light work, owing to one or more of the following: the weakness of the abdominal wall, loss of blood, adhesions in the abdomen, or a biliary fistula.

After an abscess of the liver has been opened, the patient will be incapable of work for at least two months after the wound has healed, and will probably never be fit for heavy work. (See Abdomen, p. 46; and Rupture—Ventral Hernia, p. 693.)

#### Recurrence.

There is no liability of the recurrence of the effects due to an injury of the liver.

**Occupation Disease.**

There are no occupations specially entailing injuries to the liver. Alcoholism enlarges the liver by a process of disease. (See Alcohol, p. 61.)

**Diagnosis.**

Pre-existing disease would only be discovered at the operation.

**Malingering.**

There is nothing special to note in malingering of injuries to the liver, except that an alcoholic subject has been known to attribute the enlargement of his liver to an accident instead of alcohol.

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*For legal cases of Injury to the Liver see CASE GUIDE : Liver.*

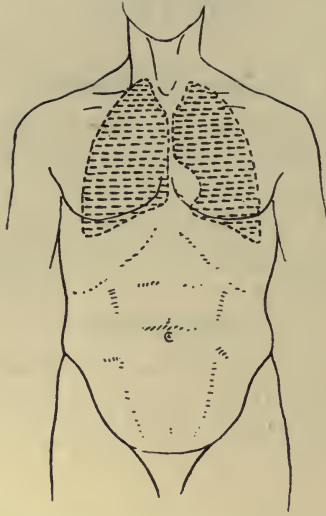


FIG. 135.—PROJECTION OF THE LUNGS AS SEEN THROUGH THE FRONT OF THE CHEST WALL.

The notch in the left lung is the spot where the heart touches the chest-wall without any lung intervening.

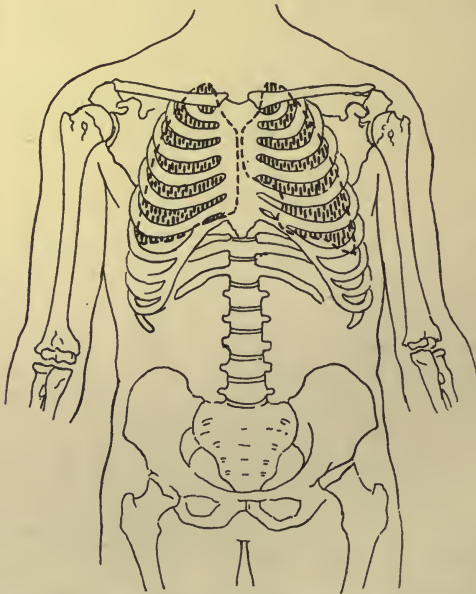


FIG. 136.—PROJECTION OF THE LUNGS AND BONES OF THE TRUNK, SEEN FROM THE FRONT.

The base of the right lung is slightly pushed up by the liver, which lies beneath it, and is separated only by the diaphragm. It will be noticed that the lungs in front hardly go below the seventh rib in front on the left side.

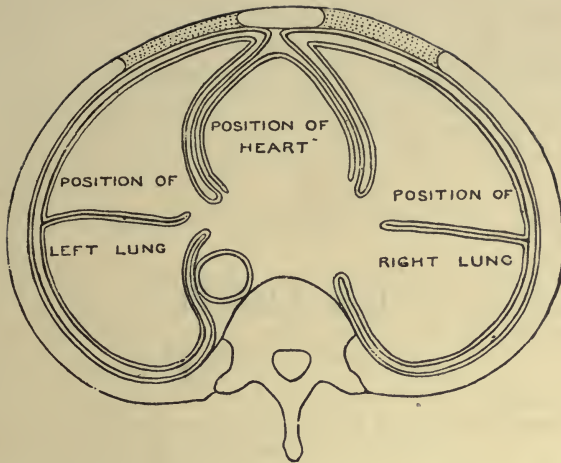


FIG. 137.—DIAGRAMMATIC SECTION THROUGH THE CHEST, CUTTING THE HEART AND BOTH LUNGS.

The heart will be seen in its sheath (the pericardium). The right and left lungs are also sheathed in their covering (the pleura), which passes into the deep fissures of the lungs, to separate the lobes. Both heart and lungs are attached to the spine behind, and this attachment and space for the heart is called the "mediastinum."

(From Buchanan's "Anatomy.")

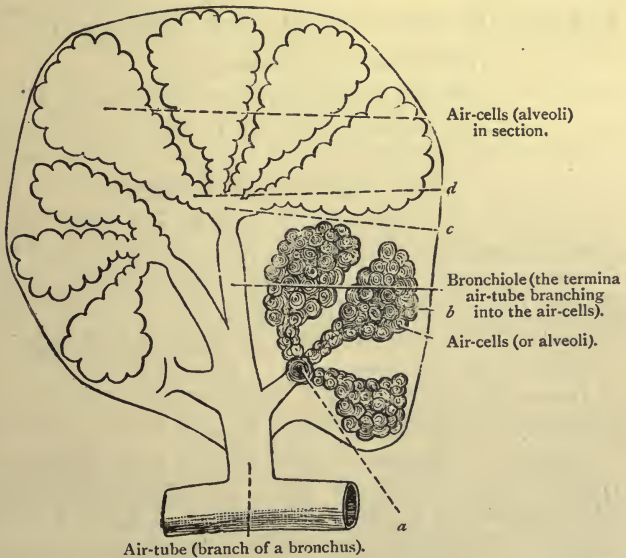


FIG. 138.—THE ENDS OF THE AIR-TUBES IN THE LUNGS (MUCH MAGNIFIED AND DIAGRAMMATIC).

Inflammation of the air-cells occur in pneumonia, of the tubes in bronchitis, of both in broncho-pneumonia.

(From Buchanan's "Anatomy," after Testut.)

# THE LUNGS.

By JAMES BERRY,

B.S., F.R.C.S.,

Surgeon to the Royal Free Hospital and to the Mount Vernon  
Hospital for Diseases of the Chest.

AND

THOMAS D. LISTER,

M.D., B.S. (LOND.), M.R.C.P.,

Physician to the Mount Vernon Hospital for Diseases of the Chest  
and to the Royal Waterloo Hospital.

## Head-note.

THE essential dangers arising from injuries to the lungs are—

1. Difficulty of breathing.
2. Bleeding from injury of some large bloodvessel.
3. Inflammation set up in the injured lung.

## Technical Terms.

*Actinomycoſis*.—A disease due to a fungus which occurs in certain grasses, sometimes affecting the lungs.

*Adhesions*.—The fixation of the lung to the chest wall caused by pleurisy (inflammation of the pleura.)

*Ālvōōlī*.—The smallest air-cells, into which the ends of the finest divisions of the air-tubes open. [Fig. 138.]

*Ānthrācōsīs*.—Coal-miner's black lung, a form of fibroid lung caused by the particles of coal inhaled.

*Ānthrāx*.—A disease, usually caught from animals, caused by a microbe which sometimes infects the lungs as well as the skin and other parts of the body. (See Anthrax, p. 89.)

*Āpēx*.—The blunt and rounded upper extremity of the lung beneath the collar-bone.

*Āsphỳxia*.—The condition produced in the body by deprivation of oxygen (*e.g.*, in suffocation).

*Asthma*.—A spasmodic difficulty in breathing, attended with long wheezing inspirations.

*Atelectasis*.—A persistence of the originally airless condition of the lung in the unborn child, which usually fully expands its lungs at birth. Sometimes part of the lung remains in this unexpanded state for some time after birth. Contrast this state with collapse below.

*Base*.—The base of the lung is the broad part resting on the diaphragm.

*Bronchiectasis*.—A diseased condition in which there is irregular dilatation of the air-tubes of the lung, leading to the formation of pouches in which offensive expectoration collects, and from which it is spat up from time to time.

*Bronchi*.—The main divisions of the windpipe. [Figs. 187, 188.]

*Bronchitis*.—Inflammation of the lining of the bronchi.

*Bronchö-pneumonia*.—An inflammation of the small air-tubes and of the lung itself round the ends of the small air-tubes. It causes the lungs to become solid in little patches. Bronchitis in infancy or in old age, and in certain diseases, is liable to lead to broncho-pneumonia.

*Cavity*.—A cavity in a lung is an excavation due to destruction, usually by tubercle bacilli.

*Collapse*.—Collapse of the lung is shrinkage due to the disappearance of the air within it. (Contrast with atelectasis, which is lung that has never properly expanded at birth.)

*Congestion*.—"Congestion of the lungs" is a layman's term for pneumonia. Strictly it means increase of blood in the part affected, and occurs in many conditions and various parts of the lungs from various causes.

*Consolidation*.—Replacement of air by inflammatory products, causing the part of the lung affected to become solid.

*Crēpitations*.—Crackling sounds heard inside the chest of one suffering from certain forms of lung disease, heard by applying the ear to the chest or by means of a stethoscope.

*Dry Pleurisy*.—Pleurisy without the presence of fluid (without effusion)—in contradistinction to "wet" pleurisy, or pleurisy with effusion.

*Dyspnœa*.—Difficulty in breathing; shortness of breath.

*Effusion*.—Fluid in the pleural cavity, frequently the result of pleurisy.

*Emböliism*.—The blocking of a branch of an artery by a displaced blood-clot lodging in it. Pulmonary embolism occurs when a branch of the artery to the lung is so blocked. (See Infarct.) [Figs. 195, 196.]

*Emphysema*.—An abnormal presence of air in the tissues of the body. Pulmonary emphysema is a diseased condition of overstretching and rupture of the small air-cells of the lungs which is caused by over-distension of the lungs with air.

*Ēmpyēma*.—The presence of matter (pus) in the space (the pleural cavity) round the lungs, between the chest wall and the lungs.

*Expectoration*.—The secretion of the lungs which is expelled by coughing.

*Fibrōsis, or Fibroid Lung*.—A toughened condition of the lung due to some inflammation of long standing. It is a chronic, incurable condition.

*Fibroid Phthisis* (pr. *Thŷsis*).—A toughened, fibroid condition of the lung due to slow consumption. Recovery from consumption is accompanied by fibroid change in the healed part.

*Gāngrēne*.—Mortification due to local death and decomposition.

*Grinder's Rot*.—A fibroid condition of the lungs occurring in grinders.

*Hæmōptŷsis*.—The coughing up of blood from the lungs.

*Hæmōthōrax*.—Blood in the space (the pleural cavity) round the lungs, between the chest wall and the lungs.

*Infarct*.—The solidification of part of the lung caused by the congestion of the bloodvessels and other changes which occur when a clot is carried to, lodges in, and blocks, a branch of an artery (embolism).

*Lōbes*.—The main divisions of the lungs: the right has three, the left two. [Fig. 137.]

*Mason's Lung*.—A form of fibroid lung which occurs from the inhalation of particles of stone and dust in the occupation of a mason.

*Œdēma*.—A sodden condition or swelling caused by the excess of fluid in the lung tissue itself, apart from the bloodvessels; a swollen, watery, dropsical condition of the lung.

*Phthisis* (pr. *Thŷsis*).—Tuberculosis. When strictly limited to the lungs it is called "phthisis pulmonalis."

*Pleūra*.—The thin skin or membrane which sheathes the lungs, and also lines the inner surface of the ribs. In consequence there are two surfaces of the pleura in contact with each other—the one covering the lungs and the one lining the chest wall. There is normally a trace of fluid to act as a lubricator, and allow of free expansion and retraction of the lungs. Sometimes this skin becomes inflamed, with or without the formation of fluid. This condition is then called "pleurisy." If with fluid, it is called "wet pleurisy," or pleurisy with effusion; if without fluid, "dry pleurisy." When the fluid is matter (pus), the condition is called an "empyema." The skin (pleura) which covers the lungs also spreads in between the separate divisions (the lobes) of the lungs. [Fig. 137.]

*Pleural Cavity*.—The space between the different layers of the pleura is called the "pleural cavity," though there is no actual cavity, as the lungs are closely applied to the chest wall in health; it is only in unhealthy conditions, causing a separation of these two layers, that a cavity may be said to exist. [Figs. 136, 137.]



*Pleurōdýnia*.—Pain over the chest wall; it may be caused by pleurisy, or by some inflammation of the nerves under the ribs (a condition like neuralgia), or from other affections of the muscles, bones, or other parts of the chest wall.

*Pleurīsy*.—See above, Pleura and Dry Pleurisy.

*Pleurō-pneumōnia*.—See below, Pneumonia.

*Pneumōnia*.—Inflammation of the lung substance itself, as contrasted with inflammation of the tubes (or bronchitis). When, as is common, the skin covering the lung (the pleura) is also inflamed, the condition is called "pleuro-pneumonia."

*Pneumōthorax*.—A condition caused by accident or disease, in which air has entered in the space (the pleural cavity) between the lungs and chest wall.

*Rālēs*.—A crackling or bubbling sound caused by disease, audible to the ear applied to the chest or by means of a stethoscope.

*Rhōnchī*.—Wheezing, squeaking, or creaking sounds heard in the lungs in various kinds of disease.

*Root of the Lungs*.—The attachment of the lung at the middle or its inner side to the main air-tubes and bloodvessels.

*Sidērōsis*.—Also called "knife-grinder's disease of the lungs," grinder's rot. A form of fibroid lung due to the inhalation of metal dust and grindstone dust.

*Sinūs*.—A small unhealthy channel or narrow tube which discharges matter (pus).

*Sputum*.—Expectoration.

*Vesicle*.—Another word for the alveoli, or air-spaces, into which the ultimate ends of the air-pipes (bronchi) open.

### Anatomy.

The lungs are two spongy organs formed round the repeated branching and subdivision of the air-tubes (bronchi), which start from the windpipe, and end in the lungs in minute air-bags, called "alveoli." [Figs. 135, 137, 138.]

Two large arteries convey venous blood to the lungs from the right side of the heart for aeration, and two large veins convey arterial blood from the lungs into the left side of the heart, whence it is distributed over the body. It is noticeable that the arteries of the lungs, into which blood is pumped by the heart, contain venous or impure blood, and the veins the pure blood, in direct contradistinction to the arteries and veins of the rest of the body.

The lungs occupy the greater part of the cavity of the chest, lying in close contact with the inner side of the chest wall. [Figs. 135, 136, 137.] They are each covered by a thin

membrane or bag, called the "pleura," which is formed in two layers, one lining the chest wall, the other covering the lung. A space no more than that between the eye and the eyelid exists in the normal condition between the layers, which are moistened by a little clear fluid to prevent friction in the movement of breathing. (See Technical Terms—Pleura.)

There is a space in the middle of the interior of the chest between the breast-bone in front and the spine behind, which is occupied by the heart, the great vessels, and the food-pipe. This space is called the "mēđiāstinum." [Fig. 137.]

### Consequences of Accident.

The principal accidents to the lungs are—

- (i.) Contusions.
- (ii.) Wounds and lacerations.
- (iii.) Inhalation of irritants.
- (iv.) Foreign bodies entering the lungs.
- (v.) Injury caused by overstrain (as might occur in certain occupations, as glass-blowing).

(i.) **Contusions.**—These occur as the result of direct violence or pressure applied to the chest wall—*e.g.*, by a cart-wheel passing over the chest.

Contusions of the lung may occur without fracture of the ribs or external wound. It is sometimes found that the damage done to the lung is greater where there is no external wound than where there is one.

The injured person will suffer some difficulty in breathing, and may spit blood. The accident usually ends in complete recovery. Sometimes permanent damage results.

(ii.) **Wounds and Lacerations.**—These are caused by penetrating wounds from the outside of the chest, or from damage by the ends of broken ribs, with or without wound of the skin. Gunshot wounds may cause the bullet to lodge in the lung, or carry fragments of clothes, or wads, or even part of the chest wall, into the lung, or may simply cause a complete perforation, the bullet passing right through the body. Any wound of the lung will cause blood-spitting, and may cause also bleeding into the pleural cavity, and often external bleeding through the wound.

Eventually recovery takes place, with some adhesion of the lung to the chest wall, or progressive local trouble commences from the entry of microbes into the parts round the wound;

this may be followed by septic pneumonia or general blood-poisoning.

(iii.) **Inflammation from Inhalation of Irritants.**—Chemical vapours or other noxious gases, or minutely divided solid particles, may enter the lungs in certain employments—*e.g.*, bleaching works, where gaseous chlorine is used, and knife-grinding, in which particles of steel and stone enter the lungs.

The effect of these is to cause bronchitis or inflammation of the lung, followed, in the case of inhalation of irritant gases or vapours, by—

Recovery when the irritation is not too concentrated or too prolonged.

Death from asphyxia.

Death from poisoning by the vapour inhaled. (See Nitrous Fumes.)

Death from the resulting inflammation.

(iv.) **Foreign Bodies.**—Foreign bodies lodge in the lungs, and they may be either liquid or solid. The result is inflammation, spreading from the situation where the substances happen to lodge. In some cases a dangerous form of inflammation (septic pneumonia) is started. If the closure of the pipe or filling of the smaller tubes be sufficiently extensive, death from asphyxia results. (For foreign bodies in the air-passages, see Nose, p. 592; and Trachea.)

(v.) **Overstrain.**—This may lead to rupture of the small air-cells and escape of air into one of two situations—into the tissues or into the pleural cavity. Air may scatter among the tissues round the lungs and in between the air-cells, even spreading up into the chest (into the pleural cavity).

The result is that, instead of the lungs filling the chest, they become smaller, because air fills the space between the chest wall and the lung, producing a condition called “pneumothorax.”

In this condition the lung on the affected side is retracted, and is to a greater or less degree useless, owing to its inability to expand. The air which passes down the air-passages fails to distend it, because there is also air inside the chest outside the lung.

Air in the chest (pneumothorax), outside the lung, is often fatal; but in injury or overstrain in healthy people, not followed by inflammation, the air is gradually absorbed, and complete recovery occurs. Pneumothorax more frequently occurs in disease than from accident, especially tuberculosis; but whether

from disease or accident, matter (pus) frequently forms in the space (the pleural cavity), giving rise to a condition described as "pyo-pneumothorax." (See below, Occupation Diseases.)

### Disease.

1. **Caused by the Accident.**—(i.) *After Contusions.*—Local inflammation in the bruised area may result in congestion, possibly leading to pneumonia, or even abscess of the lung.

(ii.) *After Wounds.*—Wounds which open the pleural cavity are serious. The consequence may be an acute simple pleurisy which gets well in time, leaving adhesions; but if the cavity be filled with blood or other fluid, it very easily becomes infected with microbes through the wound or from the blood. This infection may take place through the chest wall when it has been punctured by a wound, or through the lung when it has been lacerated by a broken rib, or from matter (pus) elsewhere, by carriage of the microbes to the lungs by the bloodstream. In consequence of any of these, matter is easily formed in the pleural cavity (empyema). This is a tedious disease requiring operation.

(iii.) *Inhalation of Irritant Gases and Solids* may cause immediate or subsequent inflammation of the lungs, which may be cured or end fatally according to circumstances.

In the case of the irritation of inhaled solid particles during employment, a form of chronic inflammation is set up, leading to a fibroid lung. This is very slowly progressive, and, if the occupation continues to be followed, is incurable, but may be arrested at the stage it has reached if early change of occupation is made.

All forms of fibroid lung are prone to become the seat of tuberculosis, when the condition becomes one of fibroid phthisis. The patient is then liable to the same risks as in ordinary consumption which has attained to the same degree of destruction of the lung. That is to say, that tuberculosis beginning in a fibroid lung is more serious than if it began in an undamaged lung, because some damage has been done already by causes (dust, etc.) other than the microbe of tuberculosis. Fibroid lung is really the result of an attempt at healing. Fibrosis is strictly comparable to the formation of visible scars elsewhere resulting from burns, wounds, or sores. All scars tend to shrink and draw together neighbouring parts. In fibroid lungs the heart may be displaced, or the chest itself deformed, by this shrinking. The movements of the chest and

remaining lung are interfered with, and the patient is therefore always in a condition of risk.

(iv.) *Foreign Bodies*, by blocking of the air-passages and absorption of the air behind the obstruction, cause collapse of the lung and bronchitis, septic broncho-pneumonia, abscess of the lung, fibrosis and bronchiectasis, and may eventually lead to even tuberculosis—*i.e.*, consumption. (See *Foreign Bodies in Air-Passages*.)

(v.) *Overstrain*.—See below, *Occupation*.

**Secondary Disease.**—*Pneumonia*.—Pneumonia is a not infrequent occurrence from the result of an accident to some part of the body other than the chest, as, for instance, a wound which, having admitted microbes, has become infected so that matter is formed. Later on pneumonia arises as part of a general blood-poisoning.

*Septic Pneumonia* may follow any inflammation associated with microbes producing matter (pus) in the upper parts of the air-passages, as, for instance, when a foreign body is caught in the windpipe (trachea), or when a cartilage broken by accident in the upper part of the trachea is being slowly destroyed and discharged. The microbe-containing matter (pus) round these injured parts may enter the lower air-tubes of the lungs and cause a very fatal form of pneumonia.

*Hypostatic Pneumonia*.—Any accident to an elderly patient which confines him to bed, such as fractured thigh, is liable to lead to a form of pneumonia, due to stagnation of blood in the lowest parts of the lungs (which will be the back if he lies on his back). This is due to the posture preventing proper entry of air into the lungs, and to the enfeebled circulation of advancing age. It is called “hypostatic pneumonia,” and is the commonest cause of death of elderly people who are kept to bed in consequence of an accident.

2. **Existing before the Accident and aggravating its Effects.**—Any general disease of the body, whether of the lungs, kidneys, heart, liver, or nerves, etc., is likely to be aggravated or made worse by an injury to the lungs, which causes serious interference with the due performance of respiration, and so affects the changes of the blood which are so necessary for good health.

This is especially true in the case of pre-existing diseases of the lung itself, which are easily rendered far worse by injury to the diseased lung. Phthisis, chronic bronchitis, and over-distension (known as “emphysema”), are examples in point.

The same kind of observations apply to any condition of general ill-health, such as anæmia, malnutrition, exhaustion, and alcoholism.

### Operation.

#### The Need for, and Risks of, Operations on the Lungs.—

In cases of severe lacerations due to accident, operations are undertaken in order to sew up the wound or stop the bleeding. A collection of fluid products of inflammation in the pleural cavity, whether it be of simple fluid (serous fluid) or of matter (purulent fluid or pus), producing an empyema, or, more rarely, an abscess of the lung itself, may demand relief by operation. The risk depends on the condition of the patient and the nature of the operation required.

Merely to let out simple fluid from the pleural cavity is a very small operation, done with a hollow needle, and requiring only a moderate amount of trained skill; the risk is small, and the hole is at once closed. To drain off the matter of an empyema is usually a more serious operation, as in most cases part of a rib has to be cut out to enable the hole to be kept open for free discharge, which may last for a rather considerable time.

To open an abscess of the lung is a serious operation, requiring considerable skill; but though the operation is not without risk, it may be less dangerous than to leave the abscess alone.

### Cure.

**The Time for Surgical Cure.—(i.) Contusions.—**Simple contusions of the lung generally recover rapidly within a few days.

**(ii.) Wounds and Lacerations.—**In lacerated wounds the time for recovery depends on the extent and severity of the injury, and the presence or absence of complications due to the inflammation resulting from the invasion of microbes. Even in favourable cases, several weeks will elapse before the lungs are healed. When the pleura requires operation to remove fluid, the time of cure again depends on the nature of the operation. If the simple puncture with a needle is all that is required, a few days' rest will close the wound absolutely; but if removal of parts of the ribs is necessary to allow a free escape for matter (empyema), then the recovery is slow, and many months will elapse before the man is well.

Air in the pleural cavity usually becomes absorbed in a few

weeks, but if matter be formed (empyema), the time, as already stated, will be prolonged.

**Hæmothorax.**—Blood effused into the pleural cavity (hæmothorax) is often associated with broken ribs; it will usually become absorbed in a few weeks, leaving behind it nothing but more or less adhesions. Should microbes, however, obtain access to this blood, the condition becomes more serious, and matter is produced and forms an empyema, as above.

Matter in the pleura (an empyema), if neglected, is likely to discharge itself either externally through the chest wall or into the lung, or, in rare cases, in other directions—*e.g.*, through the diaphragm into the abdomen. This will delay cure indefinitely.

(iii.) **Inhalation of Irritants: Fibroid Lung.**—Should it be possible to remove the patient from unhealthy employment to healthy surroundings while the symptoms and physical signs are still those of bronchitis rather than fibrosis, an improvement in health is very likely to occur.

All dusty employments ought to be carried on under conditions of proper ventilation.

The amount of the patient's incapacity depends upon the amount of interference with breathing. Extreme shortness of breath arising from these forms of fibroid lung render the man entirely unfit for his occupation.

(iv.) **Foreign Bodies.**—If removed at once the cure is instantaneous, but if permitted to remain, disease is set up and cure indefinitely postponed.

(v.) **Overstrain.**—See below, Occupation Diseases.

### Return to Work.

All cases of injury to the lungs render the man unfit to work until the symptoms have disappeared. The chronic irritation caused by trades is discussed under Cure and Occupation Diseases.

Phthisis aggravated by an accident does not differ from phthisis acquired without an injury. The capacity for work can only be restored by prolonged treatment undertaken at an early date in the development of the disease. No man is really fit for work until several months have elapsed under observation, and after test exercises have demonstrated that there is a complete absence of symptoms following exertion. Phthisis renders a man, even when apparently cured, unfit for any occupation except such as will enable him to live under the most favourable conditions. A chronic fibroid phthisis is

not incompatible with the performance of light work, especially out of doors, such as that of a messenger, checking clerk, or tram-conductor. Even though slowly progressive, it is possible, and in fact even desirable, for such cases to continue at work. Provided their illness is kept under periodical medical supervision, such cases in the industrial classes may make but little advance even in ten or twelve years, though still presenting tubercle microbes in their sputum. But the condition is one of constant risk. In all cases where the pleural cavity has been inflamed (after pleurisy), the man must not return to work until all symptoms that are acute have disappeared. The man may have pain after this, from adhesion of the lung to the chest wall. But adhesions do not incapacitate a man from work, unless very extensive or unless the trouble is followed by some fibrous change in the lung. Painful adhesions of limited extent usually cease to give trouble, as the fixed material yields and stretches with the movements of breathing.

**Pneumothorax.**—If air has escaped into the pleural cavity, whether from a wound or from rupture of the air-cells of the lung, it renders the man unfit for work until the air is entirely absorbed.

All forms of acute pneumonia render the patient unfit for work until some time after the physical signs have disappeared.

**Bronchitis** renders a patient unfit for work for as long as the acute symptoms last, and afterwards so long as there are extensive physical signs. The slighter forms of chronic bronchitis do not necessarily incapacitate from work; but when complicated by acute attacks, or by emphysema and dilated heart, to which such cases tend in time, the patient is only fit for light occupations. He may become quite incapacitated if unable to change his place of residence from England to a milder climate. Heavy work accelerates the disease.

**Fibroid Lung.**—Chronic fibroid conditions of the lung resulting from a dusty occupation render the patient in the end unfit for that employment, but usually only after many years. If not too advanced, great improvement may occur in apparently extensively affected lungs, as well as in the patient's general condition, by change of occupation.

**Foreign Bodies.**—The presence of a solid foreign body in the lung, causing symptoms, renders the patient unfit for work until relieved, and for such time after as the consequent bronchitis may last. The bronchitis usually disappears rapidly when the cause is removed. In cases where the removal of



the foreign body is impossible, changes will occur locally which may spread to the rest of the lung. Sometimes the case quiets down, and the patient seems to recover, but more usually changes of a chronic bronchitic kind, accompanied by some fibroid change, appear in the region where the foreign body is lodged. These do not incapacitate entirely, though violent efforts are likely to cause difficulty of breathing, or even dislodgment of the foreign body into another part, and a return of the acute symptoms. Should cavities or an abscess of the lung be produced, the patient is quite incapacitated, and an operation of a severe nature may be required. Such an operation may result in removal of the foreign body and recovery. But cases of this kind are incapacitated entirely until complete recovery.

If the foreign substance be a liquid, the patient is only incapacitated for so long as any bronchitis or other result of the introduction of the fluid may last.

#### Recurrence.

Accidents to the lung, once cured, do not give rise to symptoms afterwards, except there be matter in the pleural cavity (empyema).

Where empyema has once formed it may be apparently cured, but after an interval of weeks or months symptoms of a new formation of matter may appear again, and then a further operation will be required.

#### Occupation Diseases.

**Dust.**—Continued inhalation of dust produces in some individuals a lasting bronchitis, and eventually fibroid changes.

If such chronic lung disease be once set up, the man's capacity for work may vary much from time to time, according to his general condition, his environment, and the changes of the weather. With a partially fibroid lung (the disease only involving a small part of the lung) a man may remain able to work for many years. A change of employment, bringing about a freedom from the irritant producing the disease, may greatly increase the capacity for work.

Workers in the following trades are subject to affections of the lungs caused by dust:

- Coal-miners.
- Stonemasons.
- Knife and other grinders.

*Coal-miners.*—In coal-mines the continual inhalation of air charged with particles of coal causes some irritation of the air-passages, and produces expectoration of blackish sputum. Later, as the particles of coal become deposited deeper in the lung tissues, and the cough becomes persistent, the lungs develop emphysema, and the patient becomes the subject of chronic bronchitis, with shortness of breath, frequent cough, abundant expectoration, and blueness from insufficient aeration of blood, owing to deficient breathing-power. If dilatation of the tubes and fibroid phthisis follow, and cavities be formed, the expectoration is liable to become foul, and bleeding may occur from the cavities, with spitting of blood. But the amount of fibrosis met with in coal-miner's lung is usually much less than that which occurs when stone-dust is inhaled.

*Stonemasons.*—In the stonemasons' trade the irritation of the sharp particles causes more rapid changes in the lung than those which follow the inhalation of coal-dust. Fibrosis occurs much earlier, and attains a more extensive development. Adhesions of the pleura accompany the fibroid change in the lung. Cough and shortness of breath are more severe, and the expectoration may contain gritty particles.

*Knife and Other Grinders.*—The metallic (or, rather, mixed stone and metal) dust inhaled by grinders causes similar effects, with metallic particles in the sputum. In all cases infection of the infected parts by the microbes of tubercle is likely to occur, and this will greatly aggravate the symptoms, and may lead eventually to the patient's death. The sputum will contain tubercle bacilli soon after the infection of tubercle is established in the diseased lung.

*Glass-blowers, etc.*—Repeated overstrain, as in glass-blowers or cornet-players, leads to over-distension and breaking of the air-cells of the lungs (emphysema). In time this renders the man unfit to follow his employment. The degree of over-distension depends on different circumstances of the work, and varies in different men engaged in the same work.

### Diagnosis.

The differential diagnosis of lung affections the result of accident from those due to pre-existing disease depends chiefly on the previous history of the patient. The discovery of physical signs of old lung disease soon after an accident will show that the disease cannot be due to the accident.

The chief features of old lung disease as opposed to recent trouble are—

1. Evidence of shrinkage in some part of the lung.
2. Displacement of the heart resulting from shrinkage of the lung.
3. Evidence of dilatation of the bronchial tubes (bronchiectasis) or of cavities.
4. When there are signs of fibrosis present, the history of an irritating occupation, as, for instance, that of a stonemason.
5. History of previous diseases or symptoms, such as repeated blood-spitting, winter cough with loss of appetite and wasting, and so forth.

The diagnosis of the fibroid lungs which occur in trade or occupation diseases is very difficult. There are no distinctive physical signs of these forms of fibroid lungs. The history of the patient, and the microscopic examination of the sputum, where particles may be found of a special kind of dust, are the best guides to forming a correct judgment as to whether the lung was affected before the accident or not. Blood-spitting is of slight value in the diagnosis if present alone. It occurs very frequently from other causes.

### Malingering.

Pain in the chest following an accident is usually due to affection of the skin covering the lungs and lining the inner wall of the chest (pleura), such as pleurisy or adhesions, or it may be caused by affection of the nerves of the chest wall.

In the absence of any definite physical signs, it is very difficult to say whether the pain is assumed or real. The ordinary methods of detection of simulated pain are all that are available.

Asthma is occasionally simulated, but the wheezing and squeaking sounds which are produced are in cases of simulation found to arise in the larynx, and to be unaccompanied by physical signs in the lungs.

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*For legal cases of Injury to the Lungs see CASE GUIDE: Lungs.*

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## LYMPHATICS.

*See* VESSELS—LYMPHATICS.

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## MADNESS.

*See* INSANITY.

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## MALE ORGANS.

*See* GENERATIVE ORGANS—MALE.

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## MALIGNANT DISEASE.

SEE IN EACH ARTICLE (*e.g.*, BONES, BREAST, ETC.), UNDER THE HEADING DISEASE, THE PARAGRAPHS RELATING TO CARCINOMA AND SARCOMA.

## THE MALINGERER.

BY SIR R. J. COLLIE,

M D. J.P

Home Office Medical Referee, Workmen's Compensation Act ; Medical Officer to the Solicitor's and other Departments of the London County Council ; Chief Medical Officer to the Metropolitan Water Board, and to the London Fire Brigade.

MALINGERING, or the feigning of disability from injury or disease, has occurred in every age, in every country, and in every class of society. It may, indeed, be traced to that primitive instinct which causes the spider and the caterpillar, and even lower organisms, to assume, when alarmed, the appearance of death, and which incites the hen partridge to flutter, apparently with broken wing, in front of an enemy in order to allure him away whilst her brood escapes. In the Bible we are told how David "feigned himself mad, and scabbled on the doors of the gate." One need hardly call to recollection the classical stratagem of Ulysses to escape military service, except to remark that probably, in the present day, neither his conduct in ploughing the sands, nor the trick of placing his infant son in the line of the furrow to detect his imposture, would be deemed conclusive evidence of or against insanity.

### The Medical Expert and the Malingerer.

The majority of members of the medical profession are at sea when dealing with malingering, and there are many reasons why this should be so. In ordinary practice, whether medical, surgical, or general, feigned disease seldom occurs ; and when it does it is apt to be overlooked, for it can readily be appreciated that the possibility of such a solution to a puzzle has never even occurred to the investigator. He is especially apt to come to grief over a case starting in some genuine disability which has been wilfully prolonged. From the nature of their ordinary work, most practitioners are unlike examining

officers of large corporations, of prisons, or the referees of accident insurance companies, who are constantly confronted with it. Again, it requires a man possessed not only of much scientific knowledge, but of very special personality, to deal successfully with such cases. He needs wide experience, sound judgment, and a mental alertness and keenness of observation which enable him to seize at once on the slightest clue, and to follow it up to its end. A credulous, over-sympathetic man will be readily imposed upon; and a timid man, or one whose equanimity is easily upset, will be sure to bungle an examination, and, moreover, he will make a bad witness in court.

Medical men engaged in general practice have frankly admitted to me that the conditions under which they work render independence impossible. During the last year alone, I have been three times threatened with proceedings as a direct result of opinions which I have in my official capacities been obliged to express.

The medical witness should make up his mind before going into the box what line he intends to take up, and having done so, he should allow nothing to induce him to alter it. When he has once given an honest opinion, or has made a statement which he knows to be true, no amount of forensic craft should cause him to contradict himself. It is unwise to make a definite accusation of malingering unless one is prepared to substantiate it by very strong proof.

Having formed an opinion, the examiner ought to have the courage of his convictions, and be ready, if called upon, to assume the most serious personal responsibility. The average practitioner cannot be expected to go to such lengths as public servants and others whose special business it is to detect impostors, and who are to some extent protected from the results of a possible mistake. He naturally shrinks from formulating a serious charge, and from staking his reputation and his livelihood on its correctness. The truth is, he has much to lose and little to gain in this class of case.

It is always desirable that in cases of dispute a consultation should be held with the doctor, or doctors, on the other side. Many cases of malingering would be abruptly ended, and differences of opinion would be no longer threshed out in court, to the discredit of the whole profession. Nevertheless, there may sometimes be exceptional circumstances that render a meeting undesirable; for instance, His Honour Judge Mulligan, K.C., at Swaffham County Court, in the case of *Purse v. Hayward*,

made the following statement about Dr. W., who had visited a patient without an appointment with the other side :

“ Now, when a second doctor is called in by a patient or his friends, to advise or to treat that patient, I can well understand that the first doctor should be informed and meet the second (except in urgent cases). Such a rule would, if I may say so with respect, seem just in principle and beneficial in practice. But I do not see how that principle can apply when a strange doctor is going, not for the purpose of advising or treating the injured, but to make an examination on behalf of a third person. On the contrary, if a doctor be requested by a master to ascertain the condition of an injured workman with a view to resist a claim for compensation, it may be the duty of that doctor to make a surprise visit at a reasonable time. A doctor so requested must exercise his discretion, with which this court is loath to interfere. I find no ground for any complaint against Dr. W.”

In consultation with another doctor, one should as a rule be perfectly open, and try to come to some agreement, but on no account discuss the matter before the claimant or his solicitor. If, however, it is found at the outset that the doctor on the other side shows a strong bias, it is well to be cautious, and, by saying little, give away nothing.

### The Creation and Development of the Malingerer.

Most of us are frequently in the position of having small disabilities oppressing us, in spite of which we carry on our ordinary avocations, and by ignoring them prevent their getting the mastery over us. In health we are entirely unconscious of the vital processes of circulation, metabolism, secretion and such like; but by hypersensitiveness, by introspection, by fostering every form of physical consciousness, we may render many of these into conscious acts. Who has not heard his arterial blood surge through his carotids if wakeful or worried? Moreover, these clock-like mechanisms suffer seriously as the result of undue attention or self-observation. Indeed, to some extent the action of the heart can be appreciably disturbed by introspection, so that, if, for instance, we deliberately persist in sending from the brain nerve currents to the heart, we ought to remember that the resulting palpitation is due solely to our mental processes. Mind and body are most intimately connected, and constantly they react upon each other.

I have frequently seen claimants obtain, after judicial procedure, large sums of money for trifling accidents alleged to be produced in collisions which have scarcely unseated them. They had deliberately schooled themselves into resembling a condition of traumatic neurasthenia. Twenty years ago the occurrence of nervous breakdown as the result of an accident was scarcely admitted. Now we have gone to the other extreme.

Although the Workmen's Compensation Acts have been mainly instrumental in bringing these questions into prominence, they frequently arise in connection with claims at Common Law, such as those against railway companies. Reference has been made to them by Sir Thomas Oliver in his address on Industrial Insurance Problems (Life Assurance Medical Officers' Association, November 4, 1908).

Some litigants (especially illiterate people) believe that, if an accident happens, and the claimant receives a slight but narrowly escapes a serious injury (as, for instance, if a woman fell off a tramcar and grazed her shins, and whilst on the ground was in imminent risk of being run over by a brewer's dray), the damages awarded ought to bear some proportion, not to the injury actually received, but to the danger which was threatened. Others are, I fear, actuated by feelings of revenge or spite, such as may arise in the case of a cabman who is knocked off his box by a motor omnibus.

Claimants not infrequently persuade themselves that any line of conduct is justifiable in fighting an impersonal enemy. Many, even amongst the educated classes, who in all other matters exercise a strict probity, do not hesitate to exaggerate grossly when claiming from a wealthy person, from the Government, or from a large corporation, such as an insurance office or a railway company.

It is my firm belief that nine-tenths of the subjective symptoms, and often the physical signs, which I meet with in trifling accidents, are the results of auto-suggestion, or of suggestion transmitted by the doctor during his medico-legal examination. It is unwise, during a medico-legal examination, to ask an injured litigant if he is sleepless, if he *still* has the pain in his back, and questions of a similar nature. Yet, in my experience, this is not an unusual proceeding. It is obvious the object desired could be obtained by asking the claimant to detail his symptoms. If the personal medical attendant had the courage, he would at an early stage of the



proceedings cause the growth of morbid ideas to abort by resolutely declining to be a party to exaggeration and self-examination on the part of the plaintiff. I take it that the main object of medical treatment is to remove the cause of disease, so that he who advises, or even encourages, his patient to start litigation in injuries of a trifling nature can scarcely be said to be serving his patient's best interests.

Many who have obviously recovered from some genuine accident or illness still remain on the sick-list because they are afraid of evil results developing later.

Let us pass on to consider in detail the influence of injuries on the mind and body, when complicated by the hope of damages and under the stress of litigation. Those who suffer from even a slight injury not infrequently labour under a strong after-impression of pain, and are consequently ill-armed against the suggestion of pending litigation, and easily succumb to all kinds of abnormal sensations. It is noticeable that closely similar injuries, attributable to like accidents, present one kind of clinical picture and run one kind of course in the case of those who make no claim for compensation, but they present a very different picture and run a very different course in the case of those who embark upon the troubled sea of litigation. This serves to show how, under the stimulus of litigation, pain is magnified and incapacity is perpetuated.

When a workman sustains a trifling accident, his chief idea, usually, is that he must obtain substantial damages, and too often, when he has recovered from his injury, he persuades himself that he is still ill; he broods over his real or imaginary pains, until they become an obsession. Moreover, when once he has embarked on the process of a lawsuit, it is difficult for him to withdraw; his desire for damages grows with the embarrassment brought about by his loss of wages, the idea that he has been wronged is thus fostered, and the prospect of damages is, not unnaturally, his only hope. The assiduous attentions of his own doctor, the repeated medical examinations by doctors accustomed to law cases, frequent discussions with others who have made similar claims, repeated rehearsals of the details of the accident—all these factors combine to concentrate the unfortunate man's attention upon his injury, thereby creating morbid sensations of every possible kind.

Medical certificates of unfitness for duty are too easily procurable from some general practitioners, with the inevitable result that sick-pay in the various benefit societies, to which so

many working men belong, is unnecessarily prolonged. In France something like a scandal has been created by the way in which bogus certificates have been granted, and (alas for the shame of it!) lessons actually given in the art of simulation. The plaintiff believes that the defendants will minimize the injury; he considers he has an additional reason for exaggerating his wrongs, so that at last the accident becomes merely *one* of the co-operating factors in his lawsuit. Indeed, by the time the trial is reached, he is commonly the victim, not so much of the accident, as of the numerous influences which have been brought to bear on him since it occurred. If the Workmen's Compensation Act had provided, as originally drafted, that the medical part of the case be referred to an official medical referee, on the demand of *either* party, instead of *both* parties, most of the cases of this class would be satisfactorily settled at an early stage. As it stands, this clause is practically a dead letter.

#### Types of the Malingerer.

The simplest type we meet with is that of the true malingerer—*i.e.*, a rascal who invents, or grossly and wilfully exaggerates a disorder to suit his own purpose. An instance showing the extraordinary persistence of the criminal type of malingerer is recorded by Dr. Tennyson Patmore ("Ency. and Dict. Med. and Surg.," Green, 1907): A convict was sentenced to corporal punishment for flagrant misconduct. On the descent of the cat, with the first three strokes he became pale—this was the natural consequence of sudden pain—but *he added* all the appearances of dangerous syncope. His pulse and the sensitiveness of his eyes were tested, and the result corroborated the preformed opinion of the medical officer, who declared that the punishment might be continued. "Another heavy lash, only responded to by the inert human mass shaking to the weight of the blow, lying there limp and motionless, strapped to the flogging triangle! Another lash was ordered, and yet another, when suddenly the man stretched his muscles, swore at the doctor, and commenced to sing a vulgar popular song, which he continued to the end of his allotted punishment."

I am indebted to Dr. Wilfred Harris, of St. Mary's Hospital, for another interesting case of persistent malingerer:

"A burly labourer had a slight accident about fourteen years ago (prior to the Workmen's Compensation Act). As a result he developed typical left-sided hysterical paralysis,

with anæsthesia and all the well-known physical signs. This lasted for four and a half years unimproved, although he attended various hospitals. He then came under me at St. Mary's, the *left* hand being contracted, with marked blueness and chilliness. Under strong and energetic electrical treatment he gradually got well in about nine months, and returned to work as a navy for about six years. Then one day, when on a fresh piece of work, he got a blow from a barrow on the abdomen, and was admitted to St. Mary's, saying he had brought up blood. There were no abnormal signs. A month later he developed hysterical contracture of the *right* hand and arm, with blueness of the hand. The arm weakness and contracture were much less than that of the left arm seven years previously, and there was nothing the matter with his leg this time. He again attended my Nervous Diseases Department at St. Mary's Hospital, and was rapidly improving under electricity, when he ceased attending, and I was asked to give evidence for him at the Marylebone County Court. I did so, and his employer was ordered to pay him 16s. 8d. weekly until he got well, this being, of course, the worst possible inducement to recovery. Two years later I was asked by an accident insurance company to see him and report, as they had now good evidence he could use his right hand. I found him in bed, pretending he could hardly move his arm or walk, and when told to stand with eyes shut, he fell straight backwards until caught. The blueness and contracture were gone from his right hand, and he now pretended he had lost sensation of the whole of one side of his body (right hemi-anæsthesia), though with his eyes shut he made many mistakes at first, often saying, when tested with a pin, that he did not feel sensation several inches across the middle line. At the re-trial I gave evidence against him, stating that he was now malingering, and nothing more, and that he was pretending he was still suffering from the hysterical paralysis which he previously had.

“At the trial positive evidence was given by his landlord that he was able to use his right arm perfectly for everything all the time he had known him (several months): had made a bird-cage, had dug up the garden, and had fought another man! This time the insurance company won their case.”

Not long ago a man was sent to the author. He said he had been in an accident, which he proceeded to describe. He complained of the usual spinal symptoms, which he declared were accompanied by giddiness. All the symptoms were subjective,

and, as usual, he was incapable of work. I soon satisfied myself that he was a malingerer. When I was on the point of showing him out, I was asked on the telephone by the solicitor for the defence whether Mr. Y. had called upon me. I replied that I had just completed the examination. On being requested to describe him, I said he was a little, thick-set, ugly, pugilistic-looking individual. "Why," said my interrogator, "that is not the man!" He was detained whilst a detective was sent up who knew the real plaintiff, and by a subterfuge I brought them together. "Y." was an impostor, and had had the audacity to personate another man for the purpose of medical examination.

But apart from gross malingering of this description, there is a large class of malingerers the causes of whose aberrant ways are extremely complicated and diverse, and the mental processes of these impostors I shall attempt to analyze.

There are, indeed, many malingerers for whom some excuse can be found—for instance, those who, having really recovered from some genuine accident or illness, still remain on the sick-list because they are afraid of some evil result developing later. Of these we may distinguish two kinds: the alert, fussy man, who always worries about everything; and the gloomy hypochondriac, who worries only about himself. Then there are the valetudinarians, often well educated and intelligent, who are easily upset by any little illness or untoward event, and will put themselves on the sick-list for the smallest excuse.

### Traumatic Neurasthenia.

The subject of neurasthenia is being dealt with by Drs. Campbell-Thomson and Biss in this work, but as "nervous breakdown" is frequently alleged as one of the symptoms of malingering a few words on the subject may be useful.

Neurasthenia is a well-marked and very definite disease, with a host of symptoms, mental and physical, all dependent on increased susceptibility to fatigue on slight exertion. Neurasthenia sometimes follows traumatism, and although it is much more likely to follow a severe than a slight accident, it does, in fact, occasionally happen that an accident of an apparently trifling nature (especially when there is much jarring and emotional strain) sets up a condition which can be described by no other name than traumatic neurasthenia. It should be noted, however, that the neurasthenic condition is a well-

marked one, accompanied sometimes by definite alteration in the intellectual faculties, by loss of memory, and by objective changes in the special senses—vision, tactile sensation, etc.

On the other hand, many actions for damages are brought by claimants who have undoubtedly suffered from an injury of some kind, but in whom the injury has led on to no organic change or lesion, and who yet have “let themselves go.” They are pseudo-neurasthenics for medico-legal purposes. They have gradually fallen into a state of self-observation and nervousness, and have, before the day of trial (in too many cases unduly prolonged) acquired symptoms which but echo or reflect those known to be characteristic of traumatic neurasthenia. The symptoms are, in fact, due to auto-suggestion and introspection.

If the recipient of an accident deliberately allows his will to drop into abeyance and passes into a nervous condition, which cannot be cured until the result of an action at law is known, and does, in fact, recover after the trial, whether successful or otherwise, the condition is not one of traumatic neurasthenia.

Sometimes nervous mimicry may be present, and certain nerve diseases involuntarily simulated; for instance, a functional one-sided paralysis may occur, the symptoms of which, except to an expert, are indistinguishable from the much graver condition due to hæmorrhage in the brain.

This class of litigant seems very clearly to understand that the more telling the symptoms the higher will be the scale of damages. No station of life is exempt from the tendency to exaggerate when an action for personal damages is pending. The unearned increment supplies the motive.

It is true that the power of self-control is for the time in abeyance, and cannot be readily aroused, but it may be, and often is, evoked by a sufficiently powerful stimulus. It is to be remembered that whether due to accident or not, the condition is not a disorganizing one, and that even in its most aggravated form it is more a question of psychology than of physiology or surgery.

It is difficult to see why defendants should have to pay damages measured by the success of the plaintiff's capacity for practising auto-suggestion, especially when it so often happens the compensation cures what the physician could not.

The truth is that, in a large number of cases, introspection and subjective sensations are unwittingly fostered, and a traumatic neurosis is brought into being which is of psychogenic

origin, and does not rest upon the physical injury itself, but upon *the idea* of the injury, which in its turn is dependent upon the personal equation and the personality of those who are associated with the claimant in the lawsuit. The condition is really one caused by suggestion, auto-suggestion, or what might be called medico-legal suggestion. We all know, for instance, that pain in the back after an accident, be it caused by a wealthy railway company or by an accident in one's own back-garden, is much more often than not, accompanied by *no* serious pathological changes, being mostly, if not wholly, psychic.

Many cases would be more fairly fought if litigants of this class were taught that a firm determination to turn a deaf ear to their distorted sensations really makes for their happiness, and that self-effacement, self-respect, and a return to work when able are of more service and more lasting value than many coins of the realm.

The following is an example of this monoideism following an accident: An employé of a large public body was injured under somewhat sensational circumstances. The accident obtained considerable publicity, as several men were injured, and all undoubtedly had a narrow escape from death. The special conditions of service under which the men worked exposed them to considerable risk, so that by the terms of the service they were entitled to full wages during incapacity, and a handsome pension in the event of superannuation as the result of an accident on duty. One employé present at the accident received some trifling bruises, which were appropriately treated, there being no evidence of any other kind of injury. But he persisted for thirteen months in stating that he was unable to work. Six times the author returned him as fit for duty, and six times he obtained medical certificates to the effect that he was unfit for duty. As it became evident that he never meant to work, he was reported as a malingerer; his pension was now in jeopardy. The case was fully and carefully considered by a lay committee, and he was ordered to return to work forthwith, or be dismissed. He chose the former, and has worked continuously ever since.

#### Detection of the Malingerer.

In testing a supposed malingerer, one must to some extent combine the methods of the detective with those of the physi-

cian and surgeon. It is wise at times to appear somewhat credulous, and a judicious hint will often induce the impostor to betray his fraud. It is fatal to express incredulity or amusement, by word, expression, or manner, for this at once causes antagonism, and puts an impostor on his guard.

It is useful to remember that the malingerer, or he who is deliberately exaggerating, ignores the question of return to duty; he never asks, "When shall I be all right again?" If you inquire from him when he expects to be fit for work, he will answer vaguely, "I will go back when I am well."

All medico-legal cases should be examined with punctilious care; one should refuse to be interrupted or hustled, because a very little slip or omission may be pounced upon by a clever cross-examining counsel, and enable him to score heavily.

In dealing with alleged failure of sight, every means must be taken, including the use of the ophthalmoscope and perimeter, etc., to exclude genuine disease. Methods of detecting feigned amblyopia by lenses, prisms, and other tests, are detailed in works on ophthalmic disorders.

Feigned insanity is common in criminals before and after trial. Differences of opinion are apt to occur amongst medical witnesses, and can usually be traced to inexperience, insufficient care in examination, or prejudice. A knowledge of the previous history of the case and the family history are important. Still more so is practical knowledge of the behaviour of the insane, such as can only be acquired by experience. Malingerers of this description commonly overact to suit the occasion, posing at one time as maniacs, at others as melancholics, at others as dements; for they find great difficulty in sustaining the one character for any length of time.

In the case of fits, an impostor takes care not to injure himself when falling down. His face has no marked pallor or lividity; his eyes are usually firmly closed and sensitive to touch; the pupils react to light, and expand and contract normally. The duration and nature of the movements of the body are rarely characteristic, but may be when a genuine case has been studied by the impostor.

On one occasion I dropped my pencil purposely, and the patient nimbly picked it up. Later on, when I was examining his back, he declared that stooping was impossible. Stiffness in other parts of the body may be detected by similar methods.

I proved to a house-surgeon that a dear old lady (whom he had condemned to wear a back splint, for an alleged stiff

knee-joint, for many weeks) was an impostor, by removing the splint and directing her to take off her boot! Whilst I eagerly plied her with questions, she removed the unoffending boot in the usual way — *i.e.*, she crossed her legs and bent her knee.

The malingerer generally complains of pain in his back, giddiness, weakness, and inability to work. The combination of symptoms is, of course, suggestive of traumatic neurasthenia, and much care and tact may have to be exercised in deciding, especially as some of the symptoms may have been suggested by indiscreet questions asked during medical examinations.

Feigned diseases of the skin, such as rashes or ulcers, may be brought about by chemical irritants—turpentine, for example. They may be caused mechanically with pins, or by continuous rubbing with the fingers. They are always produced in some part easily accessible, such as the left arm. Compared with genuine disorders, there are usually conspicuous differences as regards the history of the onset, the position, distribution, and appearance of the eruption, and the rapidity with which it spreads or heals. There may be tell-tale spots or streaks caused by a caustic fluid having dropped or run down.

Those accustomed to dealing with cases in the public service and elsewhere, where claims for personal damages are so frequently preferred, are, as a rule, conversant with guileless but efficient methods whereby those either exaggerating or making false claims are detected. When a claimant is malingering and has been caught out, it is unwise to put him in possession of that important fact, for before the trial of the action he has ample opportunity for finding plausible explanations of the damning evidence, which should be sprung upon him only at the last moment under cross-examination or given by the medical examiner when in the witness-box.

### Cure and Return to Work.

The proper treatment of malingering is of much medico-legal significance. It is hardly necessary to emphasize the fact that, when called upon to “treat” or cure malingering, one has to vary one’s methods according to the character of the individual and the circumstances of the case.

A rogue, when detected and abruptly told that the game is up, will sometimes, but not often, throw down his cards; but, as a rule, little good is to be got by open accusation, and in medico-legal examinations it is always unwise. A



litigant of this type may very well be left to take the consequences of his own actions.

On the other hand, in the public service a serious appeal to the sense of honour, or friendly encouragement to "play the man," or even judicious neglect, have a most stimulating effect. I systematically practise therapeutic suggestion in all these cases; I state with some assurance the date when the patient ought to be well, and the knowledge that this date is immediately reported to his employer helps the suggestion. This date has necessarily to be stated with some self-confidence, perhaps even with some aggressiveness; but the assumed omniscience of the exact date when the disability will disappear, and the employé be fit to return to work, does in four out of five cases—always providing the case is not before the law courts—secure the desired effect. Moreover, the rules of the large public bodies I serve effectually prevent my living in any fool's paradise in this matter, because, if an employé does not return to work on the date named, he is sent back on that date for recertification. Some little time ago an employé (a lady) was sent to me under the following circumstances: She was doing her work in a room with an open window, when a boy threw a stone which struck her on the back of the head, so that she was forthwith incapacitated from work. She claimed compensation under the Workmen's Compensation Act, and when I called upon her in my official capacity I was informed that she had been seriously ill as the result of her injury, and was then at the seaside—where she had gone without leave—and that the latest report was that she was passing sleepless nights, the pain being incessant. She was instructed to call upon me; she came in two days, and repeated the story just narrated. As there was no mark of any violence, and she was obviously a highly-strung, neurotic, impressionable young woman, it was evident that she was the unfortunate victim of her own morbid introspection. She reminded me that she was a former pupil of mine, and implored me to suggest a remedy. She was told with much emphasis that there was no doubt she could be cured, but that I would only prescribe if she definitely gave me her word that whatever I ordered she would do. To this she solemnly agreed. She was then told that the only cure lay in her dismissing the matter from her mind, and in her going back at once to her work. This she did, and remained continuously at work for four months. She chose the better part, for what shall it profit a man, said Christie Murray,

if he gain the whole world and lose his own soul of self-respect?

I am again indebted to Dr. Wilfred Harris, of St. Mary's Hospital, for the following case of pure hysterical paralysis of twelve months' duration, cured in five minutes by the battery: "The patient had hysterical paralysis and loss of voice, and had been on crutches for twelve months. A strong wire electric brush for five minutes enabled him to carry his crutches over his shoulder back to the ward." This same man three years later almost persuaded a surgeon to amputate his hand for hysterical contraction!

The following is an example of sudden development of the will-power when violently stimulated into activity:

"A lad of about fifteen was brought into a hospital, who had had contraction of his hamstrings for two years. He sat in bed all day, and slept all night with his knees drawn up, and was unable to straighten them. On several occasions he was given an anæsthetic, and the joints at once relaxed, but immediately contracted again on his recovering consciousness. At four o'clock one morning the house-surgeon was urgently summoned to see the patient who occupied the bed next to the boy's. He had been seized by an acute attack of mania, and was wildly gesticulating with a knife. Two or three nurses were sitting on his chest, and others engaged in attempting to secure the knife. Another patient was in an epileptic fit from sheer fright, and the boy with the useless knee-joints had suddenly jumped out of bed and run downstairs! The interesting point is that the boy was made to live up to it, and was cured."

The simple neurasthenic is often cured by removal of the cause. Let me illustrate.

Not long ago a boiler-cleaner was sent to me with a view to certification as to his fitness or otherwise for further service. He complained of many symptoms of undoubted neurasthenia—amongst others, pain in the back. It appeared that his duty was to scale the rust from the inside of a boiler; that he worked in a cramped position and in a confined space, 32 feet long and 6 feet high. The boiler, being quite dark, was lighted by a colza-oil flare-lamp; drops of hot water fell frequently upon his head, and, as this condition had been continued for some four or five years, not unnaturally his nervous system became affected. I recommended that his occupation be permanently changed, and what to him was a comparatively congenial and easy task—namely, that of keeping the outside of

the boilers clean—was permanently apportioned to him. The prospect of this change of work pleased him greatly, and when I saw him again, six weeks later, he was well, contented, happy, and assured me that the pain in his back, although it had been present for a year, disappeared in the space of a fortnight.

The German workman who is making a claim may be compelled to enter a hospital, for the purpose of being kept under observation, and this has always appeared to the author to be an excellent method, and he has adopted it in dealing with some difficult and suspicious cases, when the employer has been willing to pay for the hospital treatment, with the result of cutting short several apparently chronic cases. The following are illustrative of this :

A. C., a pensionable officer, complained for thirteen months of obscure pains. He was at different dates examined by eleven doctors. He never had any objective symptoms, and was kept under observation in hospital for nine weeks, after which he was charged with malingering before his employers, who ordered him to be dismissed and to forfeit his pension if he did not at once resume work. He commenced work forthwith, and has remained at it continuously ever since.

A. D. sustained an accident, and was treated by his family doctor for thirteen months for myelitis of the spine, receiving full pay the greater part of the time. He was bed-ridden,\* and at my suggestion entered a hospital, where he had "fits," blackening his face to give them a realistic effect. I sought and obtained a private interview with him whilst in hospital. He was in bed. I ventured on some exceptionally straightforward plain speaking. Result: next day he walked a mile to my house, and five days later resumed work.

Both these cases, and many similar which I could quote, were seen by many doctors, and dubbed by all "traumatic neurasthenia"; they were, in fact, hysteria, plus malingering following traumatism. They were, as Babinski says, due to "a special psychological state," and, as the result proved, were made to disappear under "the sole influence of persuasion."

### Foreign Procedure in Traumatic Hysteria.

A brief consideration of the methods which our neighbours have adopted in dealing with these matters—the effect on the nervous system of trifling accidents—will be of interest. On the Continent much attention has been directed to the growth,

the result of the accident laws, of what Hoche has called "a great popular epidemic of traumatic neuroses."

In Germany many decisions have been given in which the psychological factor in claims for damages has been fully investigated and recognized. In a paper entitled "Necessary Reforms of the Laws relating to Accident Insurance," contributed in 1907 to the Congress held at Baden-Baden, A. Hoche, of Freiburg, points out that the courts have recently held that—

"If the ground for the existing nervous weakness lies only in the imagination of the plaintiff, then the light transient excitation of the accident cannot be made responsible for the condition, although the plaintiff believes that his trouble should be traced back to the accident."

He proceeds to give evidence showing that in those not insured—they having a keen personal interest in recovering as soon as possible—traumatic neuroses seldom happen. On the other hand, figures are adduced to prove that the number of cases of temporary or permanent inability to work as a result of injury has largely increased, *pari passu*, with the extension of insurance benefits, the number of deaths remaining the same. In this connection, it is to be remembered that accident laws have been in force for a considerably longer period in Germany than they have been in this country, whilst they affect about twenty million persons (nearly three times as many as they do in England); and that, as full pay for the first thirteen weeks of illness is always awarded, the temptation to malingering is even greater there than in this country. Moreover, the statistics show a vast increase in the number of workmen who allege successfully that they are *permanently* unfit for work. The action of the judicature of Germany can therefore easily be understood in attempting to discriminate between the damage directly attributable to the injury, and the incapacity more properly attributable to the personal equation of the claimant.

Hoche points out that the German system tends to prolong disability by favouring the growth of "Bezehrungs Vorstellungen" (desired impressions). The narration and discussion, he says, of experiences, and the medical and legal consultations and examinations, have the effect of concentrating the mind upon the grievance and upon the injured part of body, which narrows the mental outlook and impairs the moral sense, with the result that all kinds of morbid sensations and disturbances are created. The man is idle, either because he is awaiting the result of an action at law, and fears to prejudice his case, for

of course he must not work whilst drawing sick-pay (which actually may amount to more than his usual earnings). He soon acquires a dislike for labour, and loses the wholesome compulsion of having to do his duty in spite of slight discomforts, which would probably disappear if ignored.

The following appeared in a judgment given in June, 1902, in a German High Court :

“ If the essential cause of the onset and development of the hysteria is merely the idea of having a lawful cause of claim for indemnity, then there is not causal relation with the accident.”

Among the twenty millions of insured persons, every third one is in the Government Accident Insurance. The German Courts and State Insurance Company have now gone so far as to insist that the severity of the accident must bear some relation to the general consequences. For instance, in a case where, after traumatic loss of the last phalanx of the thumb, there appeared hysterical disturbance of the arm and shoulder, the judgment stated that—

“ It was not the influence of the accident which essentially caused the trouble, but the brooding of the plaintiff over the presence of its results, and his endeavours to make them a reason for indemnity which would pay him.”

Space permits of only a few words with regard to French procedure. Brissaud, in the *French Journal of Neurology*, March, 1908, describes a condition which he states is one of the unexpected effects of the French Accident Law of 1898. It is spoken of as a *new* disease, to which he has given the name of “Sinistrosis.” He describes it as a “psychical accident,” caused by the fixed idea which takes possession of the injured workman, that every accident occurring in the course of work constitutes a damage admitting of indemnity. The Fourth Chamber of the Tribunal non-suited a plaintiff workman on the ground that “the incapacity with which the workman in this case seems to be affected, results not from the accident, but from the erroneous opinion which the injured man formed of the rights to which he was entitled, by persuading himself that an income was necessarily due to him. In these circumstances he is not entitled to ask for the allocation of an allowance.”

“ If this judgment is jurisprudence,” a contemporary naïvely remarks, “there is reason to hope that Sinistrosis will find in it the curative treatment that doctors have, until now, been unable to discover!” Brissaud claims that the preoccupation of the patient, in still feeling his imaginary pains, has become an

obsession, and in reality a disease. The condition has nothing to do with traumatic neurasthenia; it is produced by neither physical nor mental shock; it is an obsession which starts from a different point, and has as its aim the fixed idea that every accident in course of work constitutes damage necessitating indemnity.

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*Part of the material used in the compilation of this article appeared in the "Medical Magazine" in December, 1908, and part formed a communication to the Medico-Legal Society in March, 1909.*

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*For legal cases of Malingering, see CASE GUIDE: the Malingerer.*

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## MAMMA.

*See* BREAST.

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## MEDICAL EVIDENCE AND MEN.

*See* EXPERT EVIDENCE.

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## MEDULLA OBLONGATA.

*See* BRAIN.

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## MENINGES, MENINGITIS, etc.

*See* BRAIN.

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## MERCURY.

*See* POISONS—MERCURY.

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## MESENTERY.

*See* ABDOMEN, INTESTINES, PERITONEUM, RUPTURE, STOMACH.

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## MINER'S ELBOW.

*See* BEAT HAND, ETC., AND BURSAE.

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## MINER'S WRIST.

*See* JOINTS AT p. 500.

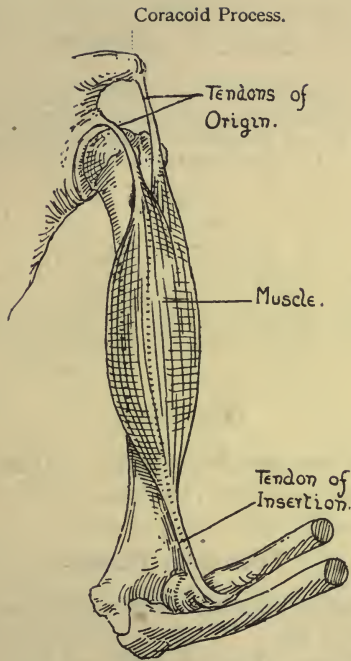


FIG. 139.—THE ORIGIN AND INSERTION OF A MUSCLE (THE BICEPS).

# MUSCLES.

By A. H. TUBBY,

M.S. (LOND.), F.R.C.S. (ENG.),

Surgeon to the Westminster Hospital and to the Royal National Orthopædic Hospital for the Deformed; Consulting Surgeon to the Evelina Hospital for Children;

AND

E. ROCK CARLING,

B.S. (LOND.), F.R.C.S. (ENG.),

Assistant-Surgeon to the Westminster Hospital; Senior Assistant-Surgeon to the Seamen's Hospital, Greenwich.

## Head-note.

THE most serious consequence likely to arise from injury to a muscle is loss of power of movement.

## Technical Terms.

*Cramp*.—A violent involuntary contraction of a muscle most common in the calf of the leg.

*Hĕrnĭa (of a Muscle)*.—The protrusion of some part of a muscle through its fibrous sheath when injured.

*Insertion (of a Muscle)*.—The place on a bone where the muscle is attached, and where the force of the muscular contraction is applied. The origin (of a muscle) is the end of the muscle opposite to the insertion. It is the fixed point from which the muscle acts (Fig. 139).

*Myōsĭtis*.—Inflammation of a muscle.

*Tĕtānic Contraction*.—A continuous violent, painful contraction of a muscle, which is not under the control of the individual. It occurs in the disease called "tetanus" or "lock-jaw" (see Tetanus), in strychnine-poisoning, and from electric shocks of high voltage during the flow of the current.

*Voluntary and Involuntary Muscles*.—See below, Anatomy.



### Anatomy.

The muscles of the body are divided into two main groups—the voluntary and the involuntary.

The voluntary include the muscles of the arms and legs, and all other muscles which are more or less under the control of the will, though there are a few places where these muscles exist without the will being able to direct them.

Involuntary muscles are those found in the walls of the stomach, intestines, bloodvessels, etc. They are not under the direct control of the will.

### Consequences of Accident.

- (i.) Contusion.
- (ii.) Strain.
- (iii.) Rupture.
- (iv.) Wounds.

(i.) **Contusion.**—A contusion sometimes leads to protracted disability. This is particularly the case with the deltoid muscle (the big muscle which forms the rounded point of the shoulder). Heavy blows on it may result in inability to use the limb for weeks. The causes are various. In some cases disability results from fluid poured out between the fibres of the muscle and into the fibrous tissue beneath it. In other cases the nerve which supplies the muscle, the circumflex nerve, is bruised or injured; in yet other cases fluid is formed in the shoulder-joint. Cases of injury to the deltoid muscle are often difficult to diagnose, and are refractory to treatment; but so long as no fracture or dislocation is present, ultimate recovery takes place, if the patient perseveres with the treatment.

(ii.) **Strains.**—Strains of muscles can seldom, if ever, be distinguished from the simultaneous effects upon their tendons or the fasciæ enclosing them. (See Fasciæ, p. 339, and Tendons, p. 783.)

(iii.) **Rupture.**—Rupture of muscles occurs as a result of direct blows and sudden strains, such as violent attempts to recover the balance. The rectus femoris (the big muscle in front of the thigh) and the rectus abdominis (the middle muscle of the front of the belly) are the most prone to suffer.

(iv.) **Wounds.**—Clean incised wounds are of no particular importance unless the line of injury is transverse to the direction of the muscle fibres, when the amount of separation of

them may be great. If this occurs in the abdominal wall a ventral rupture may result. (See Abdomen, p. 35 ; and Rupture at p. 693.)

Punctured wounds, unless infected, will not cause serious damage, although a wound from the point of a foil or small sharp instrument may completely sever such small muscles as those acting on the eyeball.

The condition known as hernia of a muscle, or protrusion of muscle fibres through the sheath, is rare, and is only occasionally attended by pain or loss of function.

### Disease.

1. **Caused by the Accident.**—It is difficult to say to what extent injury or accident is responsible for diseases of muscles.

In rare instances a chronic inflammation of muscle (myositis) may result from injury, and lead to calcareous (chalky) or osseous changes, which prevent contraction of the muscle, and so lead to limitation or loss of movement.

2. **Existing before the Accident and aggravating its Effects.**—*Muscular Degeneration.*—After some protracted illness, such as typhoid fever, the muscles may degenerate, and are then liable to rupture from comparatively slight causes.

### Operation.

Ruptured muscles may need suturing, and sometimes the blood effused at the site of rupture must be turned out. An abscess may form later on and require opening. Transverse wounds of muscle fibres call for stitching together (suture), and a special (plastic) operation may be needed to get the separated ends together.

When a muscle protrudes through its sheath, it may be advisable to repair the rent.

### Cure.

- (i.) Contusion (*e.g.*, deltoid)—fourteen to fifty-six days.
- (ii.) Strain—fourteen to twenty-eight days.
- (iii.) Rupture—twenty-eight days.
- (iv.) Wounds (transverse), from twenty-one to thirty-five days.

### Return to Work.

A week after the time allowed for surgical cure of the various injuries to muscles is a sufficient period of further rest, at the end of which work may be resumed.

### Recurrence.

Except that a hernia through a scar in the abdominal wall (a ventral hernia) is apt to recur after it has been cured, there is no risk of recurrence of the consequences of accidents to muscles after the cure is complete.

### Occupation Diseases.

Ossification of muscles towards the tendon at their extremities is seen in the "grip" muscles of horsemen. Prolonged repetition of one movement, as in working a machine, may result in an inflammation of the muscles (myositis), which is nothing more than a severe degree of the stiffness so commonly felt after unaccustomed muscular effort is indulged in.

### Diagnosis.

Complete severance of a muscle can be recognized if well-marked objective signs are present. In cases of incomplete rupture, especially of the muscles of the back, a sudden onset immediately after the alleged accident, with uninterrupted or progressive symptoms and the exclusion of the more common constitutional causes of local pain, are points in a diagnosis of disability from injury.

### Malingering.

The strain, sprain, or rupture of a muscle is one of the easiest things to allege, and one of the hardest things to disprove. Pain in the back has become a byword among workmen, who are fully aware that "if you say you have got a pain in your back, nobody can't say you haven't got it."

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*For legal cases of Injury to Muscles, see CASE GUIDE: Muscles.*

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## NECK.

See THROAT, TRACHEA, SPINAL CORD:

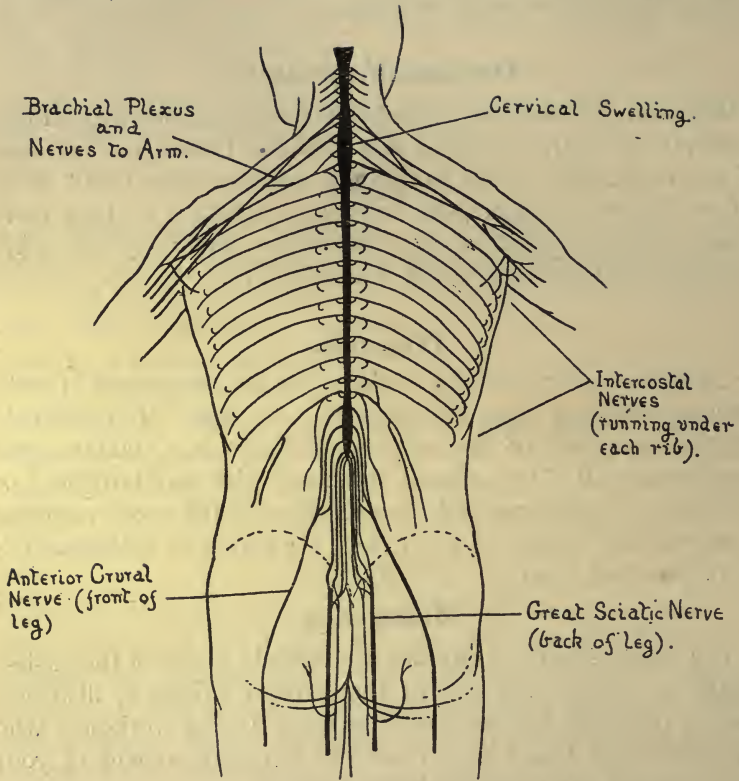


FIG. 140.—NERVES FROM THE SPINAL CORD. TRANSPARENCY DIAGRAM, SHOWING THE MANNER IN WHICH THE NERVES FROM THE SPINAL CORD SUPPLY THE BODY.

The arm is supplied by the nerves from the neck uniting and forming the "brachial plexus"; the chest by separate nerves running under each rib, "the intercostal nerves"; the legs by branches of the "sciatic plexus," the "anterior crural" to the front of the leg, and "sciatic" to the back of the leg.

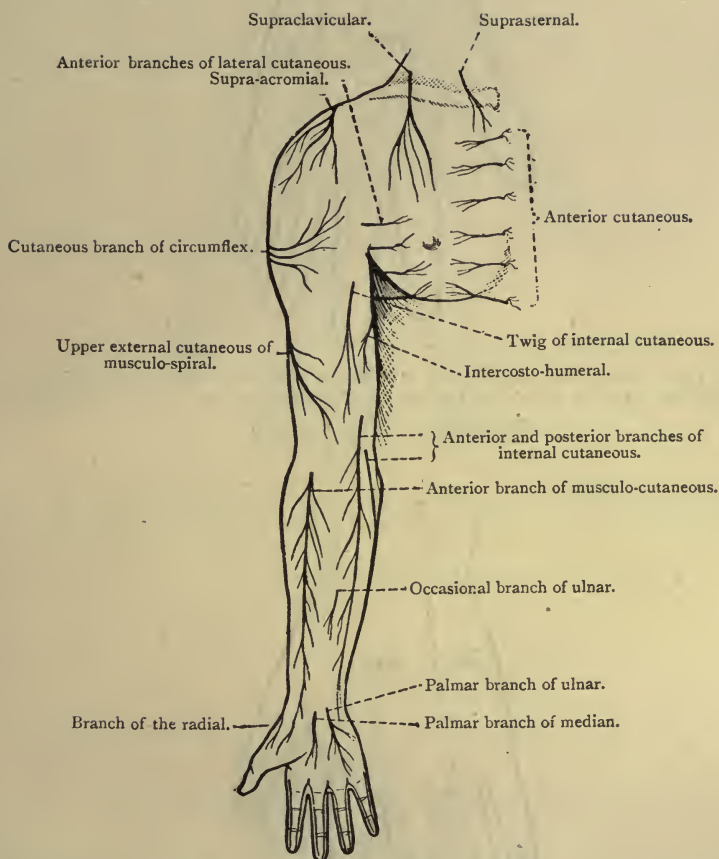


FIG. 141.—DIAGRAM SHOWING THE USUAL DISTRIBUTION OF THE NERVES TO THE SKIN OF THE FRONT OF THE ARM.

Injury to one of these nerves will be followed by loss of sensation for the area which the nerve supplies. The nerves are seen as thick lines issuing from the deeper parts of the arm, and branching into five fibres supplying the skin.

(From Buchanan's "Anatomy.")

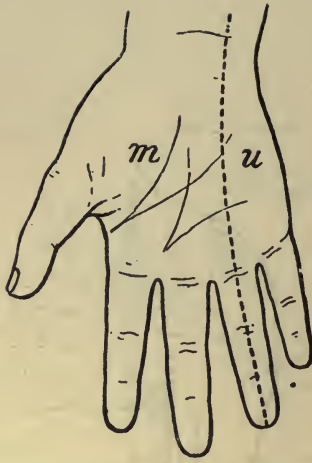


FIG. 142.—FRONT OF THE HAND, DIVIDED BY THE DOTTED LINE INTO TWO AREAS OF SKIN (*m* AND *u*) SUPPLIED BY THE MEDIAN AND ULNAR NERVES.  
(From Rose and Carless's "Surgery.")



FIG. 143.—BACK OF THE HAND, SHOWING THE AREAS OF SKIN SUPPLIED BY THE ULNAR (*u*), RADIAL (*ra*), AND MEDIAN NERVES (*m*).  
(From Rose and Carless's "Surgery.")

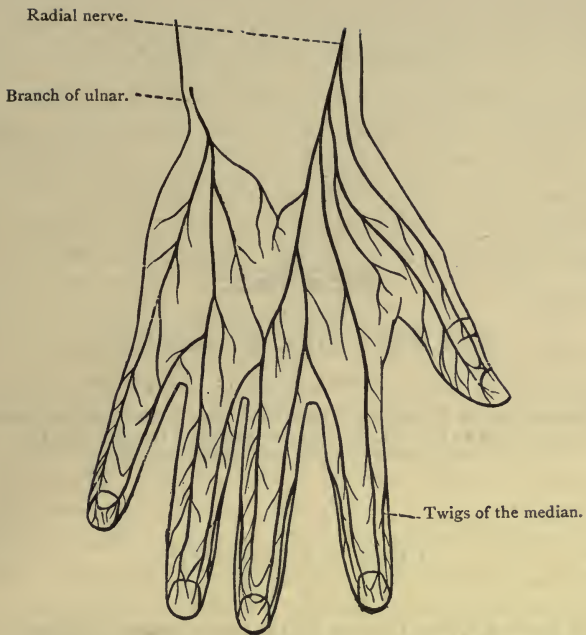


FIG. 144.—NERVES SUPPLYING THE SKIN OF THE BACK OF THE HAND, SHOWING THE AREAS SUPPLIED BY THE RADIAL, MEDIAN, AND ULNAR NERVES, AS ILLUSTRATED IN FIG. 143.

(From Buchanan's "Anatomy.")



FIG. 145.—RIGHT HAND, SHOWING THE CONTRACTION OF THE MUSCLES PRODUCED BY ULNAR NERVE PARALYSIS ("MAIN-EN-GRIFFE," OR CLAW-HAND).

(From Rose and Carless's "Surgery.")

# NERVES.

BY FREDERICK E. BATTEN,

M.D., F.R.C.P.,

Physician to the Hospital for Sick Children, Great Ormond Street ;  
Physician to Out-Patients to the National Hospital for the  
Paralyzed and Epileptic, Queen Square ;

AND

PERCY SARGENT,

M.B., B.C., F.R.C.S.,

Surgeon to the National Hospital for the Paralyzed and Epileptic, Queen  
Square ; Surgeon to Out-Patients, St. Thomas's Hospital.

## Head-note.

THE possible consequences of injuries to nerves are—

1. Paralysis and wasting of muscles, with consequent disability and deformity.
2. Loss of sensation in the skin, and loss of certain functions when special nerves are involved, such as the nerve of vision or the nerve of hearing.
3. Neuralgia, and persistent pain and tenderness in the area of distribution of an injured nerve.
4. "Trophic changes" in the skin, joints, nails, hair, and muscles.

## Technical Terms.

See Brain and Spinal Cord.

*Neurōma*.—A very rare fibrous tumour containing nerve fibres. A form of it known as "false neuroma" is not uncommon as an enlargement of the upper end of a cut nerve. It is then often painful and is one of the causes of painful stump after an amputation.

*Referred Pain*.—See below, Diagnosis



### Anatomy and Physiology.

The nerves arise from groups of cells (nuclei) in the brain and spinal cord, which are in their turn connected with either sensory or motor centres in the brain. There are thus *cranial* nerves (see Brain) and *spinal* nerves. From these sources the nerves pass to all parts of the body, some to produce contractions of muscles, hence called "motor nerves," and some to convey sensations of various kinds from the body to the brain, hence called "sensory nerves."

Some nerves contain only motor fibres—*e.g.*, the facial—some only sensory—*e.g.*, the radial—but most of the larger ones contain both kinds of fibres and are called "*mixed nerves*."

The sensory nerves carry sensations of various kinds. In addition to the "special senses," such as vision, hearing, taste, etc., there are sensations of touch, pain, heat, cold, sense of position, and the power of discriminating objects by their feel. By "muscular sense" and "joint sense" is meant the nervous mechanism whereby a person is kept continually aware of the position of the various parts of the body. Thus, in the dark, and without touching any surrounding objects, one can tell accurately the exact angle to which, for example, the elbow-joint is bent.

In addition, the sensory nerves control the health of the skin which they supply, interference with which produces the "trophic" changes described under "Consequences of Accident."

Sensory nerves have a definite distribution, so that injury to any one produces, according to the nature of the injury, definite symptoms of loss or alteration of sensation in a definite area, which is known for each individual nerve. [Figs. 140, 141, 142, 143, 144.]

Motor nerves also have a definite distribution to definite muscles. The cutting of such a nerve is followed by paralysis, wasting, and the "reaction of degeneration" (see Electrical Testing, p. 283) in the muscle which it supplies.

For the symptoms known as "referred pain" and its meaning, see Diagnosis.

For the most part, the large nerves are deeply placed and protected from injury, but in certain regions they are nearer the surface, or pass in close relation to bones and joints, in which situations they are more exposed to damage—*e.g.*, the ulnar nerve, lying in a bony groove behind the elbow.

In the neck certain of the nerves from the spinal cord are gathered together into a bundle (brachial plexus) for the supply of the upper limb. [Fig. 140.] Those which come off from the region of the back (dorsal nerves) remain separate, and pass round the chest and belly for the supply of those parts; those which come off from lower down in the cord are gathered together into a great bundle (the lumbo-sacral plexus) for the supply of the lower limb. [Fig. 140.]

### Consequences of Accident.

Nerves may be injured in a variety of ways. They may be completely or partially divided by a cut; injured by a blow; torn across completely or partially by a wrench; perforated or divided by a bullet wound; torn in fractures and dislocations, or pressed upon by the new bone (callus) formed during the process of repair of a broken bone. (See Bones at p. 132.)

(i.) **Complete Division of a Nerve.**—This, if unremedied by operation, causes permanent paralysis and loss of sensation in the area of distribution of the nerve.

Changes rapidly set in in the part that is cut off from its nerve-supply. These are called “trophic changes,” and affect the muscles, joints, skin, and its appendages. The muscles waste, and undergo characteristic changes in their reaction to electric currents, known as the “reaction of degeneration.” This reaction is most important in diagnosis. (See below, Diagnosis; also Electrical Testing of Muscles, p. 283.) Further, deformities result from unopposed action of sound muscles, such as the “claw hand” of ulnar nerve paralysis. [Fig. 145.] The skin becomes thinned, smooth, and shiny; the nails become brittle and deformed; and ulcers are liable to form, because the part is markedly liable to injury on account of its insensibility. These ulcers are known as “trophic ulcers.” (For the other consequences in the cut nerve and elsewhere, see below, Disease.)

(ii.) **Partial Division of a Nerve.**—This usually leads to consequences of a similar nature to those observed when the nerve has been completely divided, yet with distinct differences. The power of conduction in the uncut part of the nerve may be lost from bruising or bleeding at the time of the injury, from which a certain amount of recovery is possible; later the conduction in the uncut part may be lost from contraction of the scar tissue formed during healing. But if conduction remains in

any part of a nerve, there may be only partial paralysis, with modified changes in the electrical reaction (see Diagnosis), and the loss of sensation may be different. But the most striking difference between complete and partial division of a nerve, such as the ulnar, is that in the partial division pain and acute tenderness in the area of distribution of the nerve are marked features, and the changes are more marked in the skin, which becomes thin, red, and shiny ("glossy skin" of Paget). Also, as a rule, a painful and tender lump is formed upon the nerve at the site of injury.

(iii.) **Lacerations and Contusions of Nerves.**—Nerves may be injured by direct blows producing bruises, or by wrenches or strains, as in dislocation or fracture of bones. Any violent stretching, such as occurs in the brachial plexus in falls upon the shoulder, when the head and shoulder are forcibly separated, may cause a complete rupture of a nerve trunk, rupture of some of its fibres only, stretching without rupture, or hæmorrhage into the nerve sheath. Any of these will produce partial or complete loss of the function of the nerve, which may be temporary, and pass off rapidly, or be permanent, according to the damage done.

The lesser degrees of these accidents are sometimes recovered from without operation, but such recovery is impossible where a nerve has been torn completely across.

(iv.) **Pressure upon Nerves.**—Such pressure may arise from the use of misfitting crutches—*e.g.*, paralysis of the musculo-spiral nerve in the upper arm from this cause, the so-called "crutch palsy"; from displaced fragments of bone in fracture; or from the new bone (callus) thrown out in the repair of a fracture. (See Fractures.)

In such cases the paralysis gradually increases during the continuance of the pressure, but recovery takes place when the cause is removed, provided that it has not persisted for a very long time.

### Disease.

I. **Caused by the Accident.**—Apart from the degenerative changes already referred to in both muscles and nerves which may be caused by an injury, and which, strictly speaking, are not diseases, there is but little to be said on this head.

Owing to the loss of sensation in the part affected, it is very liable to such injuries as scratches and burns, and the damaged skin, owing to the defect in its nerve-supply, may refuse to heal, and a chronic ulcer will result. From such a focus inflamma-

tion may spread, and any of the septic complications common to all wounds may result. (See Infection, p. 436.)

Joints, owing to lack of movement, as well as, perhaps, to lack of their proper nerve-supply, become stiff and distorted; but this, again, is a degenerative change, and not a disease. Perhaps one should mention here the so-called "false neuroma" which forms upon the upper end of a divided nerve. This, which is really a mass of new-formed fibrous tissue, containing a few nerve fibres, may become extremely painful and tender, so adding to the disability produced by paralysis of the nerve upon which it is formed.

False neuromata of precisely the same kind sometimes occur in amputation stumps, forming upon the ends of the cut nerves, and resulting in tumours of varying size, which can often be felt through the skin. These swellings are tender to pressure, and may be painful enough to interfere with the wearing of an artificial limb. They are readily curable by removal, but sometimes recur again and again.

2. **Existing before the Accident and aggravating its Effects.**—The only way in which pre-existent disease is likely to accentuate the effects of a nerve injury is by so lowering the patient's vitality as to render him an unfavourable subject for accident or operation. Thus, healing is likely to be delayed in the obese and the subjects of kidney and other diseases, and whenever this happens, especially if suppuration (matter formation) occurs in the wound, the nerve may fail to regenerate. Nerves regenerate most readily in the young and the healthy.

### Operation.

Whenever a nerve has been divided, or badly damaged in any way, the fibres beyond the injured part undergo degeneration, right down to the muscle or other part which they supply. That is to say, the nerve fibres become broken up and disappear. In order that recovery may take place, new fibres have to grow down from the end still in connection with the spinal cord into the degenerated nerve. It is to allow this regeneration to occur that the following operations are necessary.

The risks of these operations are no more than those entailed by the administration of an anæsthetic.

(a) **Primary Suture.**—Whenever a nerve has been divided or ruptured, or partially divided, operation is urgent. This consists in exposing the nerve at the site of the injury, and uniting the cut ends together with stitches (sutures).

(b) **Secondary Suture.**—This is the operation required when the divided or ruptured nerve has not been united immediately after the accident. It consists in cutting off the “false neuroma” (see above) which forms upon the end nearest to the spinal cord, and stitching the two freshened ends together. The results are not so good as in primary suture.

(c) **Nerve-Grafting, or Nerve-Anastomosis.**—This is the operation of uniting a paralyzed nerve to a sound nerve, so that fibres may grow out of the sound nerve into the paralyzed one, and so restore its functions. Thus, a paralyzed facial nerve may be restored by joining the end which is in connection with the bony muscles of the face to the nerve which supplies the muscles of the tongue.

(d) **Relief from Pressure.**—When a nerve is pressed upon by the natural cementing material used in repair of bone [callus] or by scar tissue, the nerve requires to be freed by cutting away the callus or scar tissue which encloses it, so that its functions may be restored.

### Cure.

(i. and ii.) **Complete or Partial Division or Laceration.**—In cases where there has been division or laceration, little or no recovery is to be expected without operation (see above). If primary suture has been done, and the proper treatment has been carried out during recovery (*i.e.*, massage and electrical treatment), full recovery is to be expected in from twelve to eighteen months, but this time is subject to a good deal of individual variation.

When secondary suture has been done, the time at which function begins to be restored may be actually shorter than after primary suture; but the time for recovery to become complete is longer, and, indeed, it is doubtful whether complete recovery ever takes place when the interval between the accident and the operation has been more than a few weeks. When so long a time has elapsed between accident and operation that the muscles have ceased to contract when stimulated by any kind of electric current, and when severe joint changes, deformities, and “trophic” changes have taken place, then no recovery is possible, and operation is useless.

(iii.) **Contusions.**—After the slighter injuries, such as contusions, recovery generally takes place, so that the full use of the part is regained in from two to three months.

(iv.) **Pressure upon Nerves.**—The operation for the relief from pressure may be completely successful, and the man fit to

return to work as soon as a complete restoration of function has occurred.

#### **Return to Work.**

This will depend upon the nature of the patient's occupation. Facial paralysis would permanently interfere with the occupation of a barmaid, but would not incapacitate a navy. Division of the left ulnar nerve of a right-handed clerk would not necessarily interfere with his occupation. It should be borne in mind, however, that after suture of an injured nerve persistent daily treatment over a year or more is necessary for full ultimate recovery, and the time which this necessitates may prevent a patient from retaining his occupation, quite apart from the actual physical incapacity.

The ulnar and median nerves at the wrist, supplying the muscles of the hand, are the ones that are most often injured. Return to full work in from six to eighteen months would be possible in most occupations, but a person following some occupation requiring extremely skilled movements of the fingers, such as a violinist or a surgeon, would probably be permanently incapacitated by such an accident.

#### **Recurrence.**

When recovery has taken place there is no probability of any recurrence.

#### **Occupation Diseases.**

For lead-poisoning, causing wrist-drop, see Poisons. Writer's cramp and other occupation neuroses have been considered under Brain.

#### **Diagnosis.**

The signs of injury to a nerve are quite distinctive. The muscles which it supplies are paralyzed, become wasted, and undergo the reaction of degeneration (see below). Sensation is lost in the area supplied by the damaged nerve, and sometimes that area becomes extremely painful and tender. The "trophic" changes have already been referred to.

Wrist-drop is a symptom of paralysis due to lead-poisoning, but it is also a symptom of injury to the musculo-spiral nerve, such as may be produced by pressure on the inner side of the arm ("Saturday night paralysis" and "crutch palsy"). In lead-poisoning both arms are more or less affected, whereas in injury only one side is affected.

**Referred Pain.**—Sometimes the pain due to pressure upon, or other damage to, a nerve is felt by the patient, not in the nerve at the site of the injury, but in the area of distribution of the nerve, perhaps at a considerable distance from the site of damage. This phenomenon is known as “referred pain.” Thus, in fracture of the clavicle, if a fragment is displaced so as to press upon the underlying nerve trunks, the pain may be felt in, or referred to, the fingers, although there is nothing wrong with the fingers themselves. Again, disease or injury of the spine in the middle of the back may cause pressure upon nerves, the pain of which is referred by the patient to the lower part of the belly. Similarly, the pain of early disease of the hip-joint is not infrequently felt in, or referred to, the knee only, both joints being supplied by the same nerves. (For Electrical Testing of Muscles, see page 283.)

### Malingering.

Any malingering of paralysis from injury to a nerve would be readily detected by the distribution of the supposed paralysis, since it is not likely that the muscles supplied by any given nerve would be known to the malingerer; by the electrical reactions; and by the reflex movements produced by the application of painful stimulation. This does not take into consideration the wilful infliction of wounds and pressure, both of which are possible. On the other hand, it is easy for the malingerer to complain of intense and persistent pain in the course of a nerve. In true neuralgia the nerve is usually tender and sensitive to touch, and the course of the nerve is not likely to be known by the malingerer.

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*For legal cases of Injury to Nerves, see CASE GUIDE: Nerves.*

**NEURASTHENIA.**  
**(TRAUMATIC NEURASTHENIA AND ALLIED**  
**NEUROSES.)**

By H. CAMPBELL THOMSON,

M.D. (LOND.), F.R.C.P.,

Physician to Out-Patients at the Middlesex Hospital; Physician to the  
Hospital for Epilepsy and Paralysis, Maida Vale.

AND

HUBERT E. J. BISS,

M.A., M.D. (CAMB.), D.P.H.,

Medical Examiner and Referee to the Sun Insurance, Legal and General  
and other Insurance Companies.

**Head-note.**

NEURASTHENIA is a condition in which there is a general loss of nervous power, without the existence of any recognizable changes in the tissues of the brain, spinal cord, or nerves, to account for such loss of power. Traumatic neurasthenia indicates that the condition of neurasthenia is the direct consequence of externally applied injury to the whole or part of the body, or of some violent emotional affection induced by a catastrophe or apprehended catastrophe. Properly understood, the expression "traumatic neurasthenia" indicates a definite state, and it should not be used as a convenient connotation for every ill-diagnosed condition, a cover for ignorance, and an apology for malingering.

**Technical Terms.**

*Anæsthesia.*—Loss of sense of touch.

*Analgesia.*—Loss of sense of pain.

*Lesion* (see Brain and Spinal Cord).—Damage.

*Psychosis.*—An affection of the mind.

*Trauma.*—Injury.

(For other technical terms, see Brain, Nerves, and Spinal Cord.)



**Anatomy and Physiology.**

See Brain and Spinal Cord.

**Consequences of Accident.**

An accident to the trunk or limbs, if of considerable severity, may have a general effect on the nervous system and produce neurasthenia, but this condition is much more likely to be brought about by violence applied directly over the nerve centres—that is to say, over the vault of the skull or the spinal column. It is within the knowledge of everyone that a severe accident, such as a fall from a great height, may produce unconsciousness, and consequently loss of nervous power, whatever part of the body actually strikes the ground; but that these symptoms are liable to be brought about by a much shorter fall if the subject lands on the top of the head. The same principle applies in the case of neurasthenia. But, of course, it is no more necessary that a person should suffer in any degree from neurasthenia because he sustains an injury to the head than that he should become unconscious from a fall on the head. Many people sustain head injuries every day, and only a small proportion suffer from either temporary unconsciousness or subsequent neurasthenia. Neurasthenia may also occur after severe force has been applied to the spinal column, though, as a general rule, the condition is less severe than when it follows an injury to the head. Apart from definite injury, neurasthenia may be caused by powerful emotional stimulus. After an earthquake, accompanied by widespread destruction of life and property, neurasthenia is by no means uncommon among the survivors. In other catastrophes, such as fires, railway accidents, and mine explosions, persons who have had narrow escapes, especially those whose fate has hung in the balance for a long time, may become temporarily neurasthenic.

Neurasthenia, then, consists in enfeeblement of the nervous system, which is manifested by a temporary inability of the body and the brain to perform their functions with due efficiency.

After severe injury or shock the symptoms rapidly declare themselves. In milder cases the signs may be delayed or overlooked for a week or two, and even then not reach their maximum intensity for some little time.

### Disease.

**Caused by Accident.**—From what has been said, it will be gathered that neurasthenia is a disorder of function and not of structure, and that it presents phenomena, mental, moral, and physical in character.

Before studying neurasthenia in more detail, we must mention another functional disturbance of the nervous system, which also occasionally follows an injury. This is the condition known as hysteria. Like neurasthenia, hysteria is associated with no recognizable organic changes in the nervous system, and, from the rapidity with which cure takes place under efficacious treatment, it is apt to be regarded by many persons more as a wilful perversion of function than as a *bonâ-fide* disease.

These two divisions of the subject of functional disturbance caused by accident—namely, traumatic neurasthenia and traumatic hysteria, will now be described.

### Symptoms.

Traumatic neurasthenia may be conveniently regarded as divided into two groups—namely, mild and severe traumatic neurasthenia.

(i.) **Mild Traumatic Neurasthenia.**—Adequately to appreciate this condition, it is imperative to bear in mind that the morbidity of mild traumatic neurasthenia is concerned primarily and essentially with the psychic functions of the brain, and that the general organism, in so far as it suffers at all, suffers in the main from perversion of the mind, which, instead of controlling and adjusting the bodily economy, permits a certain degree of independence to be exhibited by the various systems and functions. The normal homogeneous working of the machine is temporarily disturbed, the fault lying, not in the parts themselves, but in the regulating mechanism. The trouble lies, then, in the mind, and in the body only through the mind; if the mind be restored, the bodily symptoms *ipso facto* vanish. For the same reason, everything which perturbs the mind, causes additional anxiety, or makes for stress, nurses the morbid state, and tends to keep it from recovery. At the same time it must not be forgotten that the patient can in these less severe types largely influence his progress by a determination on his part to look upon the bright side of things, and to disregard bad advice and unwholesome sympathy. The typical course of a case of mild traumatic neurasthenia is as

follows: A person receives a slight injury, which normally would produce no appreciable nervous disturbance. Perhaps through ignorance of physiology, perhaps through undue apprehensiveness of what may occur, and perhaps through injudicious suggestions made to him by sympathetic friends, he imagines that some baneful consequence will follow. For instance, he falls a few feet, and strikes on the small of his back. He feels a little numbness and tingling in the lower limbs, and he is a little dazed and upset. He leaves off work, goes home and discusses the case with two or three neighbours, who shake their heads ominously, and refer to similar cases in their experience, in which the patient became paralyzed or sustained a rupture of an internal organ, and was never the same again. The patient becomes restless, and fearful lest the same fate be in store for him. By the end of a week or ten days the ordinary features of a bruised back have become, to his disordered mind, the impending symptoms of life-long paralysis. Like an appetite which grows by what it feeds on, apprehension increases from day to day. The patient lies awake at night, pinching his legs to see if he has lost sensation in them; sleep is broken; he wakes unrefreshed, and has distaste for food. He is averse from exertion or exercise; his only pleasure is the melancholy one of discussing his feelings and symptoms with those who will lend ear to him. Various subjective symptoms, such as headache, backache, giddiness, pin-and-needles, loss of strength, and vague uncomfortable sensations, are commonly reported. Medical examination, however, reveals little that is objective. There may be slight tremor of the eyelids, lips, or hands; the lower limbs may be shaky, and the knee-jerk possibly increased; the pulse is often rapid, and face perhaps pale and anxious.

(ii.) **Severe Traumatic Neurasthenia.**—There is a marked difference between the mild and the severe types of traumatic neurasthenia. The latter is seldom seen except as the result of grave head injury, and in all cases the physician has to assure himself of the absence of signs of organic mischief to the brain. Severe traumatic neurasthenia differs from mild in that it usually follows promptly the immediate symptoms induced by the injury, whereas in the mild form the symptoms of neurasthenia sometimes are not apparent at first, and may not attain their maximum intensity for three or four weeks. A person who receives a severe blow on the head, with a good deal of bruising, and perhaps a large wound of the scalp, will be dazed, or, still more frequently, rendered unconscious. In this

condition, with the concomitant signs of profound shock, he will remain for some hours, and though he rallies from the shock, he may lie unconscious even for a week or more. After that, if no permanent damage has been done to the brain, complete recovery usually takes place. In a certain proportion of cases, however, as consciousness returns, the patient is found to be suffering from the train of symptoms which constitute the picture of severe traumatic neurasthenia, and this condition, in its fully-developed form, is one of great suffering to the individual and great distress to his friends. The first thing that strikes one about such a patient is his look of abject misery. He is listless, and pays little heed to what is said to him; the eyes have a dull, dazed look, and the forehead is gathered in puckers of pain and suffering. Often he buries his face in his hands, and complaint is always made of continuous pain in the head, pain so severe at times that he loses control of reason and action. Giddiness is a frequent symptom, and may cause the patient to seek support to prevent himself from falling. The vision is often disturbed, and, though no actual paralysis of the muscles, or other sign of organic disease, is present, the functions of the eye are impaired, so that the gaze cannot be concentrated on an object for long, and light causes so much distress that the muscles of the lids and neighbouring parts are constantly screwed into wrinkles in an effort to diminish the amount of light entering the eye. Other symptoms are throbbing and noises in the head, which become worse on lying down, whilst associated with them are bad sleep and horrible dreams. The power of the muscular system is markedly impaired. All movements are slow; the patient does not fling his limbs about, but moves them with deliberation and obvious difficulty. The back is bowed and the head hangs down; the gait is slow and tottering, and the lower limbs are dragged wearily along. A most important sign is change in disposition. The temper, perhaps previously cheerful, becomes morose and dour; anger is easily and often causelessly excited. It is impossible to draw the patient out of himself, and a smile never illumines his face. In a word, he is a worn, weary, beaten man.

As these symptoms are independent of organic change, the objective signs, apart from those set forth already, are few. The pulse is frequently rapid, though feeble, and the heart-beat unduly perceptible. Muscular feebleness may show itself by dilatation of the pupils, tremor of the fine muscles, such as those of the eyelids and lips, and, more exceptionally, by fine movements of

the limbs, which resemble senile tremor. The tendon-jerks not infrequently are increased, though by no means always so; and if the knee-jerk is violent, false ankle-clonus and increased plantar reflex may accompany it. General nutrition suffers, and the patient loses flesh as he loses strength. But there is no local wasting, and the electrical reactions of the muscles remain normal. In some cases definitely tender points may be found, especially on the scalp, but widespread hyperæsthesia and anæsthesia are not found in uncomplicated cases—that is to say, in cases uncomplicated with organic disease on the one hand, and hysteria on the other.

In persons who have been subject to great emotional disturbance without injury, the symptoms sometimes assume a character which appears to be due mainly to a disturbance of the sympathetic nervous system. Patients so affected have a haunted, frightened expression; they are restless and excitable; the heart beats rapidly and violently; the pulse runs at the rate of 120 or more; the carotid and other arteries flap vehemently; the pupils are dilated; and there are hot and cold sweats, perhaps local, perhaps general. They complain of incessant beating and humming in the ears, and the digestion and bowels may be upset. Sometimes there is fine tremor of the limbs.

**Traumatic Hysteria.**—A discussion as to the exact nature of hysteria need not be entered into here, but, like neurasthenia, it must be regarded as a psychosis, and it is similarly independent of organic changes in the nervous system. In its traumatic form hysteria, except as a passing phenomenon, is not very often seen in its generalized form, and hysterical fits and hysterical seizures are rare. What is more common is to find hysterical spasms, contractures, and anæsthesias, affecting injured parts. For instance, after an injury to the shoulder-joint, when the symptoms and signs of bruising and arthritis have disappeared, the patient may be found carrying the arm closely applied to the side, and she (for the subject is generally a woman) and her sympathetic friends may be convinced that she is unable to move it. There is no wasting of the muscles, but they are rigidly contracted, and will frequently remain so contracted, till by sudden emotion or judicious treatment the patient can be persuaded that there is ample power to use the arm if an effort is made. Injured fingers, or stumps of fingers left after amputation by machinery accidents, are apt, if the medical adviser is not both wise and careful, to become subject to hysterical spasms, and a person in perfect health will walk

about with a finger stuck rigidly into the air, and a profound belief that it is useless for life. Local anæsthesia is a similar condition, except that in such event the patient is affected with local loss of sensation, instead of local loss of power, though, as a matter of fact, both anæsthesia and paresis may coexist. General symptoms of hysteria are more commonly met with after accidents to the back than to other parts, especially in the condition that passes, or used to pass, under the name "railway spine." Besides local symptoms, such as functional paralysis, loss of sensation—both superficial and deep—and spasmodic contractures, one finds in such cases marked diminution of emotional control.

Finally, it must not be forgotten that patients are met with who exhibit features which are common to one or more of the groups described, and that it is not always possible, therefore, rigidly to assign an individual case to this, that, or the other category.

#### Effects.

Traumatic neurasthenia may complicate any pre-existing disease, and in certain cases there may be organic disease, shown by its definite signs, underlying symptoms of traumatic neurasthenia. In such cases the traumatic neurasthenia clears up with treatment, but the organic disease persists. The chief diseases which are liable to be aggravated by neurasthenia following an accident are the psychoses, especially insanity, hysteria, and pre-existing neurasthenia. In persons suffering from these mental states, an accident is more liable to bring on the symptoms above detailed than in a healthy person, and in definite insanity pre-existing symptoms may be aggravated.

#### Operation.

It follows, from what has been said, that no operation is called for in traumatic neurasthenia, unless it be to relieve some condition due to organic disease which occurs as a complication.

#### Cure and Return to Work.

Treatment has generally a marked effect on the duration of traumatic neurasthenia. The most important indication is to remove the patient from home. A holiday in the country or at the sea, with a judicious companion and very little physic, is wonderfully effective in mild cases, whilst more marked ones are better for being subjected to a course of isolation in an institution, rest in bed, and moral management. With

six weeks to three months of such treatment the ordinary cases recover completely. An essential part of any measures undertaken for the relief of traumatic neurasthenia, however, is that the patient shall actively co-operate with his medical attendant in seeking a cure. An effort on the patient's side is necessary, and if, through mental obliquity, he persists in turning his gaze inwards, regarding his complaints and magnifying his symptoms, the relief may be indefinitely postponed. For all these reasons, it is so eminently desirable as to amount almost to necessity that the patient shall be placed early in a hospital or nursing home if he suffers from any but the mildest form of traumatic neurasthenia; only then can he be removed from the atmosphere of injudicious sympathy and undue sense of injury which foster and prolong the condition. In the severe form traumatic neurasthenia may be prolonged indefinitely, unless treatment is rigidly carried out. A potent factor in restoring self-confidence and putting an end to mild neurasthenia is the resumption of work, especially when that work is of a manual rather than an intellectual type. Tasks sufficient to occupy the patient's attention, and thereby to abstract his thoughts from himself, form a most wholesome corrective.

### Recurrence.

Apart from fresh accident, recurrence is most likely to be brought about by the too early return to work of persons holding responsible positions, in which the mental faculties are wholly engaged, and in which success depends on personal intellectual effort. But in properly treated cases, with graduated return to work and encouragement to persevere, the risk of recurrence is small.

### Diagnosis.

Traumatic neurasthenia has to be distinguished from organic disease, insanity, hysteria, and malingering. Great care has, in the first place, to be taken to exclude all symptoms of organic disease, especially of the brain and spinal cord, and, if organic disease is found to be present, to determine if it is capable of accounting for the whole of the symptoms. The physician experienced in dealing with nervous cases often comes to acquire a power that enables him rapidly to decide this point to his own satisfaction; but, nevertheless, he has to verify his diagnosis by examination of the different organs and systems, to exclude the possibility of lurking symptoms indicative of definite lesions.

The general appearance, demeanour, attitude, and conduct, of patients is of the greatest importance in the diagnosis of traumatic neurasthenia, as in all psychoses, and in them and in the personal history the physician finds his chief positive evidence. The physical signs previously described afford confirmation, and the absence of signs of specific disease clinches the conclusion. Insanity presents difficulties in those severe cases of hypochondriasis and depression which lie on the border-line. The differentiation of neurasthenia from hysteria is more scientific than of practical purport, especially as hysterical symptoms frequently complicate traumatic neurasthenia. The chief characteristic of hysteria is the capacity for auto-suggestion, and the local symptoms of hysteria are the results of that process. The distribution of anæsthesia and paralysis is an important guide. In organic disease they are distributed according to anatomical laws, but in hysteria, not only may the anæsthesia and paralysis fail to correspond to any anatomical distribution, but they may vary from time to time both in intensity and position. Likewise, hysterical contractures and spasms may be quite unlike those seen in the organic disease which the condition is simulating.

#### Malingering.

Traumatic neurasthenia, especially in its milder forms, has been shown to be largely due to self-regard and exaggeration, and traumatic hysteria being wholly a process of auto-suggestion, the line between both of them and actual fraud is frequently a narrow one. In mild cases of psychical ailments such as these two, when no physical signs exist, the difficulty of diagnosis is frequently the difficulty of deciding whether the person is consciously or unconsciously saying what is not the fact. In nearly all cases of both traumatic neurasthenia and hysteria there is a fictitious element, and in not a few cases the whole symptomatology is so unreal as to amount, constructively, to malingering.

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### NICKEL CARBONYL AND NITRO- AND AMIDO-BENZINES, etc.

*See* POISONS—NICKEL CARBONYL, NITRO-BENZINES.

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### NITROUS FUMES.

*See* POISONS—NITROUS FUMES.



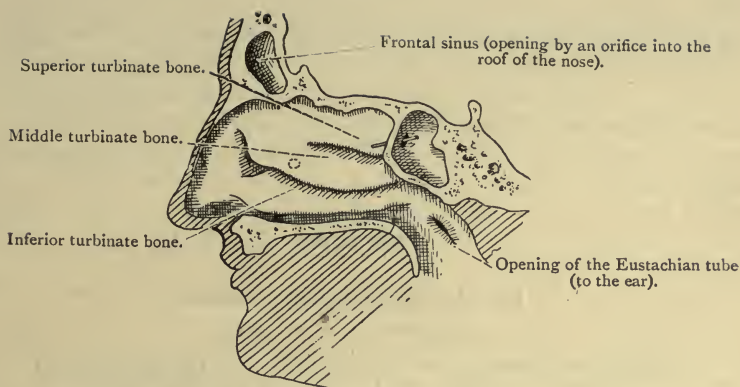


FIG. 146.—VERTICAL SECTION THROUGH THE FRONT OF THE HEAD, SHOWING THE ARRANGEMENT OF THE RIGHT HALF OF THE NOSE. THE "SEPTUM," OR PARTITION BETWEEN THE NOSTRILS, IS REMOVED.

The small dotted circle, which is behind the middle turbinate bone, is the site of the opening into the antrum. The glass rod at the back of the superior turbinate bone passes through the opening into another of the air sinuses (the "sphenoidal sinus").

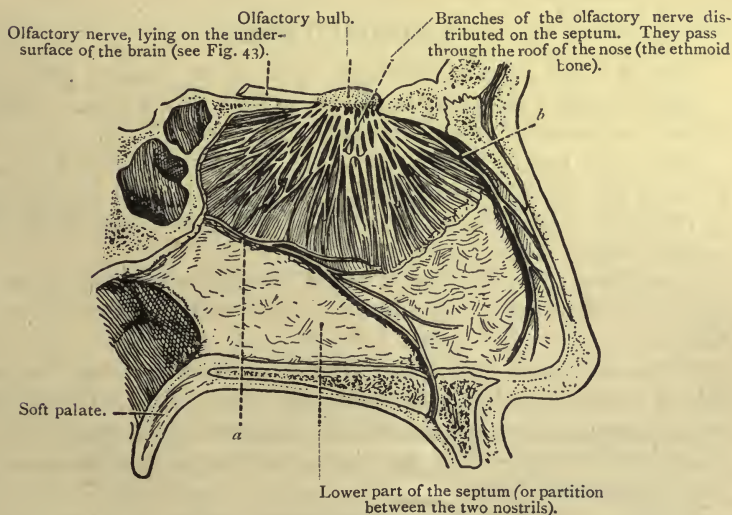


FIG. 147.—VERTICAL SECTION OF THE NOSE, SHOWING THE SEPTUM OF THE NOSE, FROM WHICH THE MUCOUS MEMBRANE (INTERNAL SKIN) HAS BEEN REMOVED, AND THE BRANCHES OF THE NERVE OF SMELL (OLFACTORY NERVE) ARE EXPOSED.

*a* and *b* are branches of other nerves of ordinary sensation.

(From Buchanan's "Anatomy.")

## NOSE.

By HAROLD BARWELL,

M. B. (LOND.), F. R. C. S. (ENG.),

Surgeon for Diseases of the Throat and Nose, St. George's Hospital ;  
Surgeon in Charge of the Throat and Ear Department,  
Hampstead General Hospital.

### Head-note.

The important consequences of injury to the nose are two :

1. Obstruction to breathing.
2. Spread of the consequent inflammation to the surrounding parts—viz., the ear, the throat, and the sinuses.

### Technical Terms.

*Āntrūm*.—The sinus of the cheek. (See below, Sinus.) [Fig. 146.]

*Ēthmoid Bone*.—A spongy thin bone in the roof the nose. Through it pass the nerves of smell (the olfactory nerves). [Fig. 147.]

*Eustāchian Tube*.—A pipe from the nose to the ear which, by allowing air to enter freely, keeps the pressure equal on both sides of the drum. The entrance to the tube is at the back of the nose on each side. [Figs. 64, 68, 147.]

*Hæmātōma*.—A collection of blood, forming a tumour under the surface of the mucous membrane (or other parts of the skin of the body).

*Lāchrymal Canal*.—The tear drain-pipe, running from the inner side of each eye and entering the nose on each side. Through this the superfluous tears are drained into the nose. [Fig. 69.]

*Mucous Membrane*.—The soft skin lining the inside of the nose (and other parts of the body).

*Nĕcrōsis*.—Death of bone, which leads to either slow decay of the piece of bone affected or its ultimate separation from the body. [Figs. 21, 22, 23.]

*Sĕptum*.—The division between the nostrils. The front part is of cartilage, the upper and back part of bone. It is rarely absolutely straight. [Fig. 147.]

*Sinüs.*—The air-spaces communicating with the nose; they are arranged in pairs between the front and back layers of the bones of the face and nose. (See below, Anatomy.) [Fig. 146.]

*Turbinate Bones.*—Three convoluted bones arranged lengthways in the nose, one above the other. They are soft and spongy, and are covered with the moist skin of the lining of the nose (mucous membrane). They warm the air for the lungs and catch the dust. (See below, Anatomy.) [Fig. 146.]

### Anatomy.

The nose is specially constructed to warm, moisten, and purify the air before it enters the lungs. It is the natural passage for this purpose, being lined with a moist skin, upon which particles of dust and bacteria easily settle. This skin is called "mucous membrane," and the bones over which it is spread, and which compose the interior of the nose, are twisted so that the greatest surface may be collected in the smallest place. These twisted bones are called "turbinate bones." [Fig. 146.]

Between the two nostrils in front is a thin plate of cartilage, which fits into a groove of bone. Part of this groove runs along the edge of a thin bony plate which divides the nose into two parts behind, so that the nose is divided by a vertical plate called the "septum," of which the front and lower part is cartilage, the upper and back of bone. [Fig. 147.]

The bridge of the nose is formed by two small plates of bone, which unite together in the middle line.

In order that the large areas of bone may be used to form the skull without unduly adding to the weight of the head, the bones of the face are separated into a front and a back layer, in certain parts between which are air-spaces, or sinuses. There are two of these in the bone between the eyes, called the "frontal sinuses"; several in the back of the nose, called the "ethmoidal and sphenoidal sinuses"; and a large one behind each cheek-bone, known as the "malar sinus" or "antrum." All of these sinuses open into the nose, and they are in consequence liable to be infected with the nose when the latter is injured and inflamed. The most important sinus is the antrum, which, instead of communicating with the nose by an opening at its lowest part, has a small hole high up on its inner wall. In consequence of the position of this hole, fluid easily collects in the antrum, and flows out of it with difficulty except when the patient is lying down.

The roof of the nose is a very thin plate of bone perforated

with numerous small holes. It is called the "ethmoidal bone," and upon its upper surface lie the large nerves, the nerves of smell, or olfactory nerves. The upper surface of these nerves is in contact with the brain, and from the lower come numerous branches to supply the nose with the power of smelling. [Fig. 147.]

### Consequences of Accidents.

The following are the situations where injuries occur to the nose :

- (i.) The mucous membrane.
- (ii.) The septum.
- (iii.) The bridge.
- (iv.) The air-spaces.
- (v.) The ethmoid bone.

(i.) **The Mucous Membrane.**—(a) *Foreign bodies* are frequently introduced into the nose by children, and if not soon removed cause inflammation. Splinters of wood or metal may be driven in by explosions, even as far as the air-spaces (sinuses).

(b) *Dust* produces a chronic inflammation of the lining of the nose. This would hardly be considered an "accident" but for its inclusion in Schedule III. of the Workmen's Compensation Act, 1906. There, by the order of the Secretary of State, "ulceration of the nose produced by dust" is a "legal accident." The same effect on the nose may be produced by hot air. (See Occupation Diseases, p. 597.)

(c) *Poisonous Processes.*—A slow ulceration of the mucous membrane, which occurs in certain trades, is included in the same Order of the Secretary of State. The Order states that diseases and their sequelæ which arise in handling of any process involving the use of bichromate of potash are to be included within Schedule III. of the Workmen's Compensation Act, 1906.

(d) *Blood-tumour* (hæmatoma) of the division between the nostrils (septum) easily forms under the lining skin of the nose if the division is injured. A thick, rounded swelling full of clotted blood occurs in the division. It takes some time to subside, and may form an abscess, which will burst unless opened. (See Operation.) In many cases permanent thickening of the parts is left.

Simple ulceration of the skin lining the nose (mucous membrane) heals without difficulty; but the ulceration of trade

diseases is very intractable, and the ulcer may eat a hole down to, and even through, the division. If the bone be exposed, it may decay (necrose), with a very foul, offensive discharge. The dead bone may come away after a long period, or be gradually absorbed. Meanwhile the inflammation may spread. (See below, Disease.)

(ii.) **The Septum.** [Fig. 147.]—The cartilage and bone of the division between the two nostrils (septum) may be bent or broken. The division may be broken by direct violence, such as a blow or fall, even without injury to the bridge. The degree of deformity, however, depends on the violence used. In any case, obstruction to breathing frequently follows, although there may be no visible alteration externally.

Bending or breaking of the division (septum) often causes a deformity which may require correction. (See below, Operation.)

(iii.) **The Bridge.**—To break the bones of the bridge of the nose requires considerable violence, and then the degree of deformity may be great, so that the restoration of the personal appearance is a matter of difficulty. The bones soon unite, though generally with some deformity. The consequences of deflection are the same as those from a bent septum. (See below, Disease.)

(iv.) **The Air-Spaces (Sinuses).** [Fig. 146.]—The air-spaces are not infrequently injured by direct violence, the patient being unaware of it; in these cases the wound heals without difficulty or complication.

These spaces are often the site of disease, or become infected from a nose inflamed from accident or other cause. In all these cases an abscess may form, and be most troublesome and intractable. As has been mentioned above, foreign bodies have been known to be driven into these spaces without showing any external wound on the face. The foreign body will probably at once set up an abscess. (See below, Disease and Operation.)

(v.) **The Ethmoid Bone.**—The importance of injury to the roof of the nose is that it may affect the brain. [Fig. 147.]

### Disease.

#### 1. Caused by the Accident.

(i.) **The Mucous Membrane.** (ii.) **The Septum.**—Chronic ulceration associated with death of the bone is common in the nose. It is characterized by two features; the first is an

extremely offensive discharge, and the second intractability. The discharge is one of the most offensive in the body, so that the neighbourhood of a patient with an offensive nose discharge is intolerable. The bone may be laid bare and slowly eroded, or may in course of time be shed as a small fragment. The division of the nostrils may be perforated by the ulcer, a result which, however, causes no trouble in itself. This long-continued discharge of matter, filled with the micro-organisms which are capable of infecting the rest of the body, especially the lungs, is a grave danger to the patient.

Such ulceration is rarely the result of an accident, but is far more often due to disease. (See above, Consequences of Accidents.)

(iii.) **The Bridge.**—There is no disease likely to arise from injury to the bridge of the nose.

(iv.) **The Air-Spaces.**—The air-spaces in the forehead and cheek are very rarely the seat of trouble caused directly by an accident; but they are occasionally infected by a foul discharge in the nose which was caused by an accident. When this occurs, it generally leads to the formation of an abscess. The matter (pus) collects in the spaces, or trickles into the nose and down the throat. This gives rise to a general poisoning of the system from absorption of matter, and there is a risk of a very dangerous form of inflammation of the lungs—septic pneumonia. Other parts near the nose may become the subject of inflammation; the tube to the ear (the Eustachian tube) may become blocked from catarrh, and deafness and trouble in the ear result. (See Ear, p. 250; and Caisson Disease, p. 202.)

2. **Existing before the Accident and aggravating its Effects.**—Any form of disease of the nose, such as tubercle, syphilis, glanders, ulcer of the septum, polypi causing chronic catarrh, or pre-existing abscess or other disease of the antrum, will render the effects of an accident to the nose more serious.

### Operation.

(i.) **The Mucous Membrane.**—The blood-tumour (*hæmatoma*) which forms under the skin lining (mucous membrane) of the nose may require to be opened, and the resulting ulcer, like any other slowly healing ulcer, may need scraping. Injection of cocaine into the spot will destroy the sense of pain, and then these operations are trivial and without risk.

(ii.) **The Septum.**—The septum, if broken or bent by an injury, will require straightening. There is no risk in this except from the anæsthetic. It is a very painful operation without chloroform, so that some form of anæsthetic is necessary.

In spite of the greatest care, the division (the septum) between the nostrils frequently remains bent. This obstructs breathing, and the patient may suffer so much from this difficulty that an operation is necessary to restore the width of the air-canal. The injection of cocaine or the use of chloroform is demanded owing to the painful nature of the operation, which is not a serious one, and the consequences of which are unimportant.

(iii.) **The Bridge.**—Setting a broken bridge is unattended by risk, except from the anæsthetic. (See Anæsthetics.)

(iv.) **The Air-Spaces** may require opening, but this operation is only called for if an abscess forms.

The operation for opening the cheek sinus (the antrum) is not serious. It is done from inside the mouth, outside the teeth. For opening the sinus between the eyes (the frontal sinus), an operation is less often necessary, as it has a natural drainage downwards, which the antrum has not; but the operation is more serious in its results. It always leaves a scar above the eye, and sometimes a marked deformity from the hole made in the bone. In both cases the discharge continues for a considerable time after the abscess has been opened, and more than one operation may be required.

The operative treatment of the sphenoidal and ethmoidal cells varies with the extent of the disease; such operations are often extensive, severe, and unsatisfactory, but exceedingly rarely called for in consequence of accident.

(v.) **The Ethmoid Bone.**—The bones forming the roof of the nose require no operation when they are injured.

### Cure.

(i.) **The Mucous Membrane.**—Simple inflammations of the skin lining the nose (the mucous membrane) heal rapidly as soon as the trouble causing them is removed. The ulceration caused by chronic irritation—*e.g.*, through dust or the “trade diseases”—is very slow, and may perforate the division between the nostrils (the septum). This, however, is of little consequence; it merely makes a communication farther forward between the two nostrils, which already naturally unite at the back of the nose.

The blood-tumour may subside slowly and leave thickening, or burst and leave an ulcer.

(ii.) **The Septum.**—The bent or broken division between the nostrils (the septum) must be straightened at once, and kept in a splint for fourteen days. All attempts to correct the deformity will frequently fail, and an operation be subsequently needed. (See Operation.)

(iii.) **The Bridge.**—The broken bridge of the nose takes about two weeks for complete union, but here also the deformity is hard to correct.

(iv.) **The Air-Spaces.**—An uncomplicated injury to the air-spaces, when no previous disease exists and no subsequent infection arises, causes little trouble, is often unsuspected, and heals rapidly without complication. If inflammation sets up, and an abscess forms in the sinus, the trouble will be great. It is impossible to fix a date for cure, which may be very protracted. (See Disease and Operation.)

#### Return to Work.

(i.) **The Mucous Membrane.**—After injury to the skin lining the nose, return to work necessarily depends on the nature of the work. There is nothing to prevent a man from working soon after an accident to the nose, unless prevented by headache, which is a common consequence of the injury. A discharge from the nose in consequence of ulceration or disease is most offensive. Consequently, the offensive nature of the discharge may prevent a man from following his occupation owing to the nuisance he will be to his fellow-workmen. There is no risk except where there are large open wounds; but a doctor or nurse, for instance, afflicted with this discharge should not attend confinements or surgical cases. (See Disease.)

(ii.) **The Septum.** (iii.) **The Bridge.**—Where personal appearance is important, a bent nose is a great disadvantage. A footman with a bent nose may find it hard to get work until it is straightened.

Obstruction to breathing is frequently a consequence of an injury to the bones or cartilage of the nose.

Even if the diseases which are mentioned above do not occur, yet difficulty in breathing may hinder a man from doing his work as well as he did before the accident (*e.g.*, cornet-player). Neuralgia is an after-effect of injury to the nose, and it may also prevent a man from following certain occupations—*e.g.*, purely brain work.



(iv.) **The Air-Spaces.**—As has been mentioned, this frequently passes unnoticed if uncomplicated, and then does not keep a man away from work. If, as is common, the sinuses get infected and an abscess forms, the headache and general illness would probably prevent him from working. He could work, but only under a feeling of considerable discomfort.

If an operation became necessary, then the time for return to work would depend on the date of cure. (See above, Cure.)

### Recurrence.

There is no risk of recurrence of any of the injuries to the nose, except in the case of the sinuses. In these spontaneous recurrence is by no means unlikely after an abscess has once formed and been healed. If the injury has healed without forming an abscess, there is no tendency to recur. Even without spontaneous recurrence the sinuses are left as weak spots. A slight blow upon the cheek will cause recrudescence of the discharge if the sinus be not entirely healed.

### Occupation Diseases.

Sudden changes of temperature will cause catarrh, from the liability of the nose to catch cold owing to alterations in temperature. The effect on the nose is not serious; but the bronchitis, which may start from obstruction to breathing, caused by catarrh of the nose, is serious. This nasal obstruction compels the patient to breath through his open mouth, which tends to produce bronchitis—more so because the back of the throat and windpipe are probably also affected by the same catarrh as the nose.

Continued inhalation of dry hot air or of dust produces an inflammation of the nose, which may proceed to perforation of the partition between the nostrils. This does not cause disability, or, indeed, any serious symptoms, and is usually discovered accidentally. Such perforations are also caused by tuberculosis, lupus, or syphilis, and it is frequently impossible to decide the cause.

A slow ulceration, producing destruction of the cartilage of the division between the nostrils (the septum), has been noticed as common in workers in bichromate of potash. The diseases and their sequelæ arising from this occupation are industrial diseases within the Workmen's Compensation Act, 1906. Cement workers also suffer in the same way, and they will

probably be held to be included in the Act under the head of ulceration produced by dust. (With regard to incapacity caused by these diseases, see above, Cure and Work.)

Ulceration in the nose is one of the least important effects of poisoning by bichromate of potash or by phosphorus, both of which produce severe effects elsewhere in the body. (See Chromium and Phosphorus.)

### Diagnosis.

It must be borne in mind that injuries to the nose generally heal well, and leave no trouble except deformity. Formation of matter and death of bone is common as a result of disease, but is very rarely due to accident.

The real point of difficulty is to determine whether or not a bending of the division between the two nostrils was caused by accident. The deflection is extremely common apart from any accident.

Disease of the air-spaces (sinuses) is common, and is rarely caused by accident. It is difficult to determine whether it has not been caused by accident.

### Malingering.

Headache is frequently, but not invariably, present after accidents of the nose. This symptom is frequently simulated by malingerers. (For other points see above, Diagnosis.)

### Criminal and Self-inflicted Wounds.

**Suicidal and Other Self-inflicted Wounds.**—Foreign bodies are introduced by children and the insane.

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*For legal cases of Injury to the Nose, see CASE GUIDE : Nose.*

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## NYSTAGMUS.

*See EYE.*

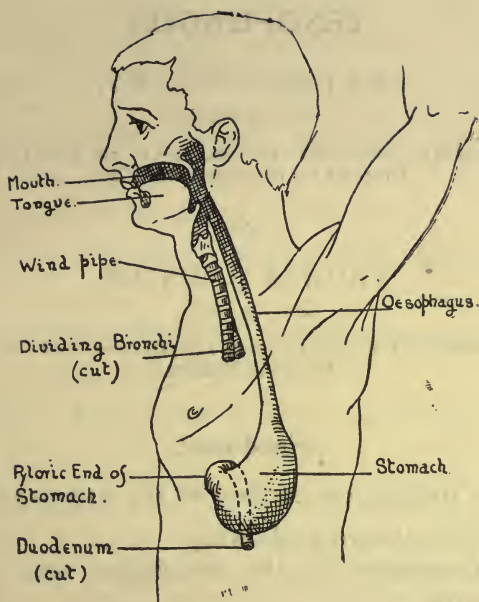


FIG. 148.—THE FOOD-PASSAGES FROM THE LIPS TO THE DUODENUM (THE FIRST PART OF THE SMALL INTESTINE).

The mouth opens into the upper part of the throat common to the communication with the back of the nose, mouth above, and the food-pipe and wind-pipe below. The space is called the pharynx. The food-pipe (the oesophagus) runs from the pharynx above to the stomach below, lying close against the spine at the back of the chest. It passes through the diaphragm (which is not shown). (See Figs. 2, 3, 4.)

# ŒSOPHAGUS.

By JAMES BERRY,

B.S., F.R.C.S.,

Surgeon to the Royal Free Hospital and to the Mount Vernon  
Hospital for Diseases of the Chest,

AND

THOMAS D. LISTER,

M.D., M.R.C.P.,

Physician to the Mount Vernon Hospital and to the Royal  
Waterloo Hospital.

## Head-note.

THE dangers arising from accident to the œsophagus are—

1. Obstruction to swallowing.
2. Inflammation in the œsophagus and surrounding parts.

## Technical Terms.

*Äörtä.*—The main artery conveying the blood from the heart to the body.

*Bougivē.*—Long, thin, flexible cylindrical rods, made in various sizes, used for detecting the situation or size of a narrow part of a canal or the presence of a foreign body.

*Dēglūtition.*—Swallowing.

*Dysphāgia.*—Difficulty in swallowing.

*Gäströstömý.*—The operation upon the stomach in which an artificial opening is made through the belly wall for the introduction of food.

*Hämätēmēsis.*—Vomiting of blood.

*Mēdiāstinum.*—The space between the lungs.

*Mucous Membrane.*—The soft moist skin lining the internal cavities of the body, especially those accessible to air.

*Œsöphägöscöpe.*—An instrument for looking down the œsophagus.

*Œsöphägūs.*—The gullet, or food-passage from the back of the throat to the stomach. [Figs. 2, 148.]

*Posterior Mediästīnūm.*—The space behind the heart containing the food-pipe, aorta, etc.

*Stricture.*—The abnormal narrowing of a pipe.

### Anatomy.

The œsophagus, or food-pipe, is a hollow muscular tube 9 or 10 inches in length, extending from the throat to the stomach, and passing downwards, at first behind the windpipe, and then behind the heart. It is in contact with the big arteries in the chest, and lies directly in front of the spine and between the lungs.

### Consequences of Accident.

The accidents to which the food-pipe is liable are—

1. Wounds.
2. Burns, scalds, or chemical corrosion.
3. Lodgment of foreign bodies.

1. **Wounds.**—Wounds are almost invariably due to objects introduced either intentionally, such as a sword in sword-swallowing; or accidentally, such as fish-bones or pins, in eating, etc. The wounds may be penetrating or non-penetrating. Wounds which penetrate the food-pipe involve a grave risk, because they may extend to the aorta and other bloodvessels, or to the lungs and heart-sheath (pericardium), or even the heart itself.

Bleeding from injury to the food-pipe alone is seldom serious or accompanied by pain, although sometimes resulting in vomiting of blood.

2. **Burns, Scalds, or Chemical Corrosion.**—Burns and scalds and chemical corrosion are due to the swallowing of hot or corrosive liquids, such as boiling water, acids, caustic alkalies, etc.

Apart from the effects on the larynx (often extremely dangerous) or on the mouth or throat, the immediate result of these injuries is difficulty in swallowing, coughing, and straining.

3. **Lodgment of Foreign Bodies.**—Foreign bodies, such as false teeth, coins, etc., may be caught and remain fixed in the food-pipe.

The immediate effects of the lodgment of a foreign body in

the food-pipe are somewhat similar to those produced by burns and corrosives. A foreign body may sometimes lie in the food-pipe for a considerable period without severe symptoms, if the food is able to pass it.

The subsequent effects of any of the above accidents may be stricture, causing temporary or permanent narrowing, inflammation spreading to the surrounding parts, or blood-poisoning resulting from microbic infection.

### Disease.

**1. Caused by the Accident.**—Inflammation may arise and lead to ulceration. This, when healed, is liable to cause permanent obstruction, or stricture from the contraction of the scar. Strictures are most intractable, and cause great trouble. If untreated, they may lead to starvation through inability to swallow.

Inflammation of the surrounding parts may also occur, generally with very dangerous, and, indeed, frequently fatal, results.

This inflammation may spread to the lungs and heart, or their coverings, causing pleurisy, pneumonia, or pericarditis.

Abscesses in distant parts may also occur from general blood-poisoning.

**2. Existing before the Accident and accentuating its Effects.**—Cancer of the œsophagus is not uncommon, and would probably progress rapidly after injury.

### Operations.

Operations for the extraction of foreign bodies are usually performed by means of instruments passed down the food-pipe. The risk run by the patient depends chiefly upon the difficulty of extraction, and the especial liability to laceration if the foreign body is large and jagged.

Operations for the relief of stricture of the food-pipe are—

1. Dilatation of the stricture.
2. Opening the stomach to enable the patient to be fed (gastrostomy).

The risks attached to dilatation are not very great, the operation being carried out by passing graduated dilators. Gastrostomy involves considerable risk, but may be the only means of averting starvation.

### Cure.

The time for cure depends upon the extent and severity of the damage. Slight wounds of the lining wall of the food-pipe usually heal very quickly. Complete cure of a narrowing (stricture) of the gullet is almost impossible, but if the stricture be kept dilated no serious results need follow.

### Return to Work.

As soon as the immediate effects have passed off, and provided no inflammatory complications have arisen, the patient is fit for work. Stricture of the gullet does not in itself interfere with the capacity of the man for ordinary work.

### Recurrence.

A stricture which has been dilated and subsequently left alone is liable to contract again.

### Occupation Diseases.

The occupation diseases are those of conjurers, sword-swallowers, etc.

### Diagnosis.

The symptoms of stricture of the food-pipe from injury are almost identical with those of a tumour or cancer occurring without injury. The history of an accident, and the appearance revealed by examination with the œsophagoscope, or the resistance offered to the passage of a bougie, may enable a correct diagnosis to be made.

### Malingering.

The patient may allege a difficulty in swallowing, when in fact none exists.

Hysterical women not infrequently complain that they are unable to swallow, or have great difficulty in so doing, when in fact there is no real obstruction or stricture.

The passage of a bougie, either under an anæsthetic or without, would clear up the case.

### Criminal and Suicidal Wounds.

Suicidal swallowing of corrosive liquids, such as carbolic

acid, is common, but there is no special feature to distinguish it from an accident.

In cut-throat the food-pipe may be severed, but so deep a wound is usually fatal. This injury has occurred in suicidal as well as homicidal cut-throat.

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*For legal cases of Injury to the Æsophagus, see CASE GUIDE :  
Æsophagus.*

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## OMENTUM.

*See* ABDOMEN, INTESTINES, STOMACH, ETC.

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## OPERATIONS.

*See* MEDICO-LEGAL NOTES—OPERATION.

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## OVARY, OVARIAN.

*See* GENITAL ORGANS—FEMALE



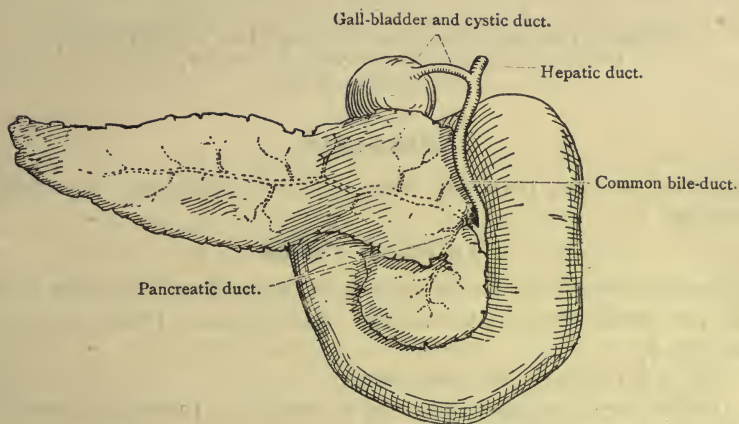


FIG. 149.—THE PANCREAS DIAGRAMMATICALLY REPRESENTED AND SEEN FROM BEHIND.

It lies stretched out as a tongue-like organ with an enlarged head, round which folds the commencement of the small intestine (the duodenum). It discharges its secretion into a duct common to it and the gall-bladder.

# PANCREAS.

By JAMES SHERREN,

F. R. C. S.,

Surgeon to the London Hospital; Surgeon to the Poplar Hospital  
for Accidents; late Erasmus Wilson Lecturer, Royal  
College of Surgeons.

## Head-note.

INJURIES to the pancreas may result in bleeding or inflammation.

## Technical Terms.

*Common Bile-Duct.*—A tube formed by the union of the tubes from the liver and from the gall-bladder. (See Liver.) [Figs. 133, 134, 149, 171.]

*Cyst.*—A tumour containing fluid.

*Duodenum.*—The first twelve finger-breadths of the small intestine. [Figs. 2, 149, 170, 171.]

*Epigastrium (Epigastric Region).*—The pit of the stomach. [Fig. 1.]

*Fistula.*—An abnormal communication between a hollow organ and the skin, or between two hollow organs.

*Necrosis.*—Death of small particles of the body.

*Pancreas.*—A large digestive gland lying across the base of the abdomen just about the level of the navel. [Figs. 2, 149.]

*Peritoneum.*—The membrane lining the abdomen and covering its organs. (See Peritoneum, p. 614.)

*Peritoneum, Lesser Sac.*—The pouch of peritoneum situated behind the stomach and covering the pancreas. (See Abdomen, p. 37.)

## Anatomy.

The pancreas (sweetbread) is a soft, tongue-shaped organ situated on the back wall of the abdomen behind the peritoneum, and just above the level of the navel. It is divided into a head, a body, and a tail. The head is situated in the curve formed by the beginning of the small intestine (duodenum—see Intestine), while the body crosses the spine, and the tail

touches the spleen. It is covered in front by the stomach, and the common bile-duct passes behind its head.

The pancreas secretes an important digestive fluid (pancreatic juice), besides having other functions which have to do with the utilization of sugar in the body. The pancreatic juice passes into the small intestine (duodenum) at an opening common to the duct of the pancreas and the common bile-duct.

### Consequences of Injury to the Pancreas.

Injuries to the pancreas that are not immediately fatal are of such extreme rarity that few medical men have ever seen them.

As the result of abdominal injuries, the pancreas suffers from—

- (i.) Contusions.
- (ii.) Rupture.
- (iii.) Wounds.

(i.) **Contusions.**—These result from direct violence to the pit of the stomach, setting up a bleeding into the substance of the pancreas, and an acute or a chronic inflammation. Acute inflammation may lead to death in a few days, or to the development of an abscess, or to an effusion of fluid into the lesser sac of the peritoneum (pseudo-cyst). Chronic inflammation may lead to the formation of a pancreatic cyst, or to symptoms due to interference with the functions of the organ.

(ii.) **Rupture.**—This will result from violence more severe than that which causes a contusion. It is exceedingly rare under any circumstances. When it does occur, it is almost inevitably associated with injuries of other organs, and in such cases is usually fatal in a few hours. But there are other cases in which the rupture is smaller and other organs are not involved. These, if not operated upon within a few hours of the accident, cause the collection of fluid in the lesser sac of the peritoneum (pseudo-cyst), or lead to a pancreatic abscess.

(iii.) **Wounds.**—These are of still greater rarity. It is almost impossible to wound the pancreas without at the same time wounding other organs. An isolated wound of the pancreas would reveal itself in the same way as a rupture.

### Disease.

#### I. Caused by the Accident :

- (a) Hæmorrhage into the pancreas.
- (b) Acute inflammation of the pancreas.

- (c) Peritonitis.
- (d) Pancreatic fistula.
- (e) Chronic inflammation of the pancreas.
- (f) Pancreatic cyst.
- (g) Pseudo-cyst of pancreas.
- (h) Jaundice.
- (i) Glycosuria (sugar in the urine).
- (j) Digestive disturbances.

(a) **Hæmorrhage into the Pancreas.**—Hæmorrhage into the pancreas is more serious than into any other abdominal organ. The pancreas is soft and easily torn by effusion of blood into it. Moreover, it secretes a powerful digestive fluid when set free in the abdomen, which causes inflammation of the lining (peritoneum) of the abdomen.

Hæmorrhage is usually caused by direct violence applied to the pit of the stomach (epigastrium). It has been said to have arisen as the result of a sprain, but this is hardly credible. Bleeding results also from acute inflammation of the pancreas.

The hæmorrhage may lead to the escape of the pancreatic secretion into the peritoneal cavity, the formation of a localized abscess, or to the production of a scar which may obstruct one of the ducts of the pancreas and bring about the formation of a cyst by the secretion collecting behind the obstruction. (See below, Pancreatic Cyst.)

(b) **Acute Inflammation of the Pancreas (Acute Pancreatitis).** (c) **Peritonitis.**—Acute pancreatitis is one of the most serious diseases that can affect an individual, and leads to death in the large majority of cases unless its progress can be checked by operation. It produces a peritonitis, and in addition the digestive fluid is set free, and produces the curious condition known as "fat necrosis," in which the living fat in the region of the pancreas undergoes digestive changes. In mild cases the escape of this fluid causes a peritonitis limited to the lesser sac, with the gradual formation of a pseudo-cyst.

(d) **Pancreatic Fistula.**—In cases in which the inflammation of the pancreas is not intense, an abscess may form in the pancreas, which on bursting through the skin produces an abnormal channel (fistula), discharging pancreatic juice.

(e) **Chronic Inflammation of the Pancreas (Chronic Pancreatitis).**—This may result from an injury, and may manifest itself by the formation of a pancreatic cyst, by digestive changes, or by obstructing the common bile-duct. (See Pancreatic Cyst.)

(*f*) **Pancreatic Cyst.**—In this extremely rare condition it is just possible that injury may play a part. There is no sign by which we can tell, even at an operation, that the cyst is due to injury, as it is liable to occur without injury. It is true that the formation of a pancreatic cyst, as the result of an injury, has been recorded by known authorities, but the proof would have to be very clear that accident was responsible for any particular case.

(*g*) **Pseudo-Cyst of the Pancreas.**—This is the name that has been given to a collection of fluid in the lesser sac of the peritoneum. This pseudo-cyst results from an inflammation of the pancreas. It is always closely related to the injury which has caused it, appearing within a short time, usually within a few days.

(*h*) **Jaundice.**—As the result of a swelling of the head of the pancreas, which may be due to disease of the pancreas, jaundice may occur from pressure upon the common bile-duct, which lies behind the head of the pancreas. Jaundice as a result of injury to the pancreas is extremely rare, but is one of the recognized symptoms of chronic inflammation of the pancreas and of cancer of the pancreas.

(*i*) **Glycosuria.**—Sugar may appear in the urine as the result of extensive pancreatic disease. But disease of this nature rarely results from an accident.

(*j*) **Digestive Disturbances.**—The pancreas is one of the most important organs concerned with digestion; it follows, therefore, that if the digestive fluid which it secretes cannot reach the bowel, or reaches it in insufficient quantity, disturbances will result. The symptoms that have been noticed are: the passing of undigested fat and meat in the motions, diarrhoea, wasting, nausea, and vomiting.

Any or all of these may result from disease due to accident.

2. **Existing before the Accident and aggravating its Effects.**—There is no disease of the pancreas likely to be aggravated by an accident.

### Operation.

It is impossible to diagnose an injury of the pancreas immediately after its infliction. The rules for the treatment of the injury in its early stage are those for the treatment of any abdominal injury. (See under Abdomen.)

Injuries to the pancreas, unless treated by operation, are almost invariably fatal. If uncomplicated by injury to other

organs, and the operation be performed within the first few hours a certain number may be expected to recover.

It is impossible to say the exact operation which will be necessary, but the organ must be well exposed, and after the peritoneal cavity has been cleansed, all breaches of surface must be sewed up and drainage provided for.

This condition is also almost invariably fatal apart from operation. By operation life may be saved in a few cases. The essence of the operation consists in the provision of free drainage.

Occasionally, in cases where the inflammation is not so acute and an abscess has formed, the abscess must be opened and drained.

**Chronic Pancreatitis.**—Where chronic pancreatitis has supervened, and has resulted in jaundice and digestive disturbances through obstruction to the common orifice of the pancreatic and bile ducts, operation is necessary to relieve this obstruction. The operation consists in relieving the pressure on the bile-duct and gall-bladder by draining the gall-bladder either on to the surface of the body or into the duodenum. The risk of the latter operation is greater than that of the former.

**Pancreatic Cyst.**—Operation is required; without it the disease slowly progresses, and eventually destroys the life of the patient. The operation consists in opening the cyst and stitching it to the belly wall, through which it is drained. The cyst then slowly closes up.

**Pseudo-Cysts of the Pancreas.**—Operation consists of opening and draining. The risk is less than that of operation for acute pancreatitis.

### Cure.

After operation necessitated by injuries of the pancreas, cure is a long and tedious affair in the greater number of cases. In every operation for pancreatic injury drainage has to be provided. This often results in the formation of an abnormal channel (pancreatic fistula) between the pancreas and the surface of the body, which may take months to close, and in some cases never closes. No operative treatment at present devised will aid closure.

After operations upon cysts or pseudo-cysts the same applies; but though these eventually close in the large majority of cases, cure cannot be expected under six months.

**Return to Work.**

A weak abdominal wall will be left after an operation for the result of injuries, and unless the abdominal wall is repaired by a further operation, it is unlikely that the patient will ever be fit for heavy work again. There is always the risk of ventral hernia through this. In any case, at least six months will elapse before any kind of work can be undertaken. (See Abdomen, and Rupture—Ventral Hernia, p. 693.)

It must also be remembered that although the life of the patient has been saved, yet so much of the pancreas may have been destroyed that loss or diminution of the pancreatic secretions, and resulting digestive disturbances, may render the patient unfit for any work, or for only the lightest work.

**Recurrence.**

There is no liability for the effects of injury to the pancreas to recur.

**Occupation.**

No occupation carries with it any special liability to injuries of the pancreas.

**Diagnosis.**

In the event of a pancreatic cyst, or a chronic pancreatic inflammation alleged to be due to an accident, should the symptoms appear some time after the accident, it is impossible by examination of the patient or by operation to determine if the accident had any share in the production of the condition. We know, however, that both these conditions have followed accident in patients where there was no question of compensation, and where the diagnosis was made and the case recorded by eminent authorities. (See Operation.)

**Malingering.**

There is nothing special to be said under this head.

*For legal cases of Injury to Pancreas, see CASE GUIDE : Pancreas.*

**PELVIS.**

*See* BLADDER, BONES, GENERATIVE ORGANS—MALE AND FEMALE.

**PERICARDIUM.**

*See* HEART

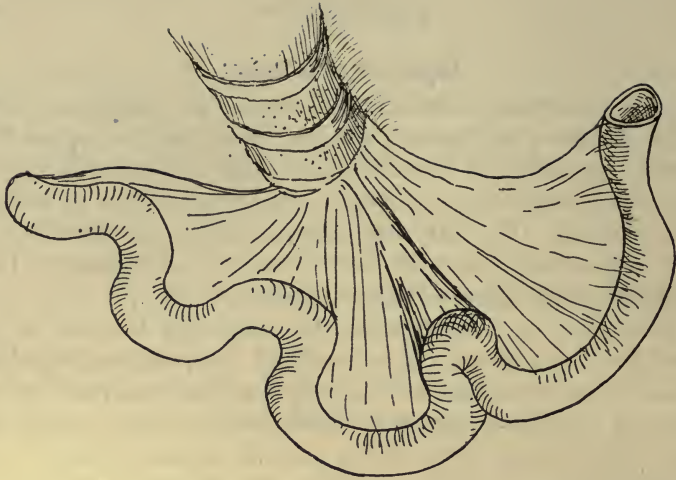


FIG. 150.—A SHORT PIECE OF THE INTESTINE, CUT AT EACH END, WITH ITS PERITONEAL ATTACHMENT (MESENTERY) TO THE SPINE, THE BODIES OF THREE VERTEBRÆ BEING SHOWN.

The fan-like method of attachment of the mesentery is shown. In actual life the intestine here shown would be about six feet or more, and the mesentery attached along its border; the other end of the mesentery, where it is attached to the spinal column, would then be about one inch in length.

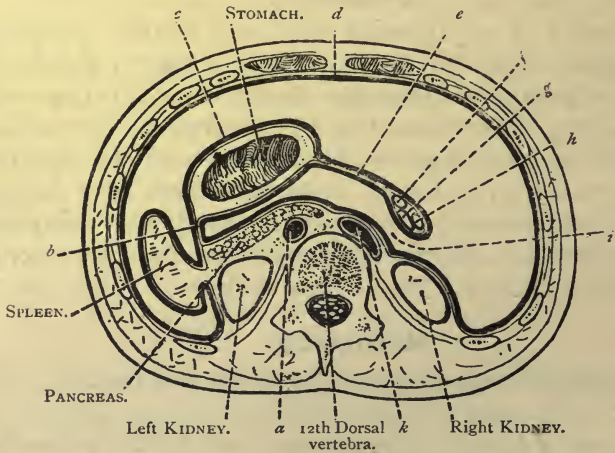


FIG. 151.—HORIZONTAL DIAGRAM OF A SECTION CUT ACROSS THE HUMAN BODY TO SHOW THE RELATIVE POSITIONS OF THE VARIOUS ORGANS AND THE MANNER BY WHICH THEY ARE COVERED WITH THE PERITONEUM.

The thick, heavy dark line represents the peritoneum, which, commencing from the left side, and proceeding round, lies against a small piece of the left kidney, then forms a loop to enclose the spleen; it then covers the stomach, front and back, turning sharp to the right over the front of the pancreas and right kidney, then, running round the entire abdominal wall, reaches the point from which we started. The level of this section is at the 12th dorsal vertebra, the last vertebræ which carries a rib. It is above the level of the mesentery.

(From Buchanan's "Anatomy.")



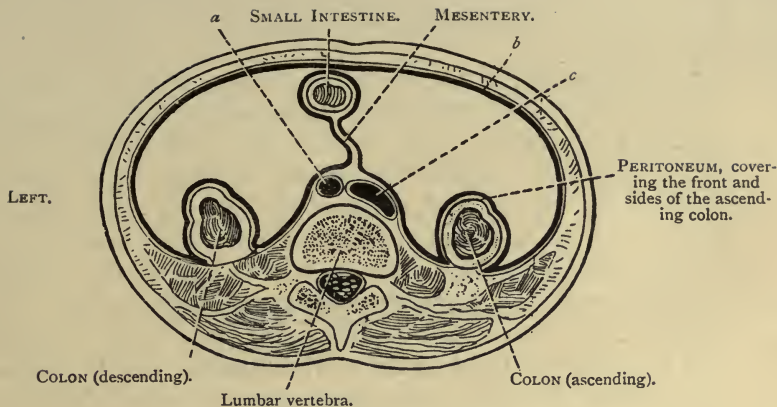


FIG. 152.—THE SAME SORT OF SECTION AS FIG. 151.

The parts cut here are at a level of one of the lumbar vertebræ below the kidney, stomach, spleen, or liver. The mesentery is here shown cut in one thin thread; it will be remembered that it is shaped like a fan, and here it is cut a short distance from the narrowest part of the fan. The large intestine is cut on the right side as it comes up as the ascending colon, and again, after it has crossed over, as descending colon. Note that the colon lies behind the peritoneum and is not ensheathed by it like the small intestine.

(From Buchanan's "Anatomy.")

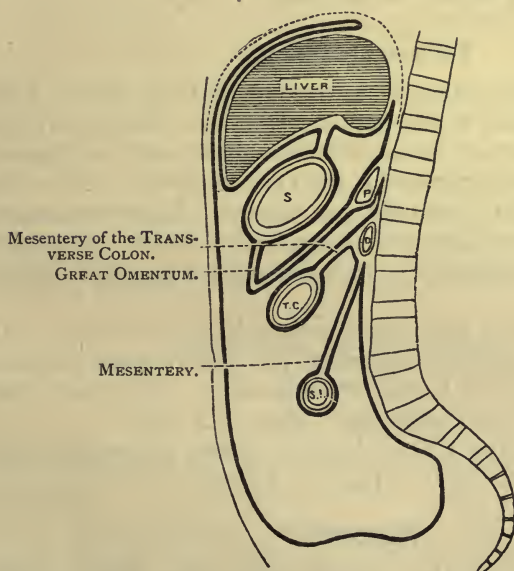


FIG. 153.—PERITONEUM, SHOWN AS FIGS. 151, 152, BUT THE BODY IS REPRESENTED IN VERTICAL SECTION.

s, stomach; p, pancreas; d, duodenum; t.c., transverse colon; s.i., small intestine. The great omentum is reduced in size, for in adult life it lies over the whole of the front of the abdomen, and would reach to the bottom of this diagram. The kidneys and spleen, as they lie to the side, are not shown. The stomach is shown as a large tube, as it is cut across, and the small intestine is shown in one representative loop, though in such a section, in fact, it of course would be many times cut. The back of the liver lies on the body wall direct, and has no peritoneum covering it.

# PERITONEUM.

By JAMES SHERREN,

F. R. C. S.,

Surgeon to the London Hospital; Surgeon to the Poplar Hospital  
for Accidents; late Erasmus Wilson Lecturer,  
Royal College of Surgeons.

## Head-note.

ACCIDENTS to the abdomen injuring the lining membrane (the peritoneum) may produce peritonitis, which is always a dangerous, and frequently a fatal, disease.

## Technical Terms.

*Adhesions.*—Peritoneal adhesions are bands of tissue formed as the result of inflammation in the peritoneal cavity. These may bind one organ to another or to the abdominal wall, and are specially liable to occur in connection with the great omentum. They may give rise to intestinal obstruction, to pain and discomfort, or they may interfere with the functions of any hollow organ. (See below, Anatomy of the Peritoneum.) In many cases adhesions cause no symptoms.

*Omentum.*—A fold of peritoneum attached to the stomach. The great omentum is the large peritoneal fold covering the intestines, and attached to the lower border of the stomach. The other omenta are attached to the liver and spleen. [Figs. 152, 172.]

*Fallopian Tubes.*—The tubes which in women convey the ovum from the ovary to the womb. [Figs. 82, 85, 86.]

## Anatomy.

The peritoneum is the smooth, thin, and highly elastic membrane which lines the abdominal wall, and passes from the back of the abdomen to cover partially or completely the abdominal organs. (See Abdomen.) [Figs. 150-153.] The peritoneum readily absorbs poisons, drugs, and bacteria. All its surfaces where they are in contact are lubricated with a trace of fluid, so that the stomach and coils of intestines can

glide freely on each other. Even without inflammation of the peritoneum, in general diseases of the body—*e.g.*, kidney, heart, or liver disease—this fluid is often much increased in quantity, constituting a condition known as “ascites,” or dropsy of the abdomen. As a result of inflammation of the peritoneum, whether from disease, such as tuberculosis, or from any other infection, this fluid is secreted in increased quantity, and is either thin or thick, in the form of a pasty white adherent substance spread over the inflamed peritoneum, and causing coherence of its surfaces where they are in contact. If this exudation be not absorbed naturally or removed by an operation, it tends to become organized into bands of fibrous tissues which are resistant to forces within and without the abdomen.

These bands are known as “peritoneal adhesions,” and are the cause of numerous conditions of ill-health in the organs to which they are attached. For as time passes these bands harden and contract, and distortions and pressures developed from their contractions displace organs, narrow canals, and press on bloodvessels. They may even form new “pockets,” or rigid passages into which the intestines can slip, and so produce an internal hernia or rupture.

If the inflammation of the peritoneum be confined to one spot, it may produce a local abscess, which may burst externally through the skin, and internally either into the general abdominal cavity or into any hollow organ. Inflammation of the peritoneum tends to occur as the result of inflammation of any organ in the abdomen. (See Abdomen, Appendix, Genital Organs—Female, Intestines, Kidney, Liver, Spleen, etc.)

### Consequences of Accident.

- (i.) Rupture.
- (ii.) Wounds.

(i.) **Rupture** of the peritoneum is a consequence of abdominal contusion.

This often produces bleeding into the abdominal cavity (intraperitoneal hæmorrhage), which, however, is rarely of sufficient severity to need operation.

Rupture of the peritoneum may also produce adhesions, which later on may cause pain, or even prove fatal through intestinal obstruction. Peritonitis easily develops as the result of injury to the peritoneal covering of the bowel, and may lead to the formation of an abscess.

(ii.) **Wounds.**—Penetrating wounds of the abdominal wall piercing the peritoneal lining are serious on account of the possibility of infection of the abdominal cavity, and consequent peritonitis. (See Abdomen, p. 39.)

### Disease.

#### 1. Caused by the Accident.—

(a) Peritonitis, local or diffuse.

(b) Intestinal obstruction.

(a) **Peritonitis.**—(i.) *Local Peritonitis.*—This may result from limited injuries to the peritoneum, or from a penetrating wound, or from spread of inflammation from hollow organs. In most cases local peritonitis subsides without needing surgical intervention, but should an abscess form, it will require to be opened and drained.

Adhesions may form which may so constrict a coil of the bowel that death from intestinal obstruction may ensue.

(ii.) *Diffuse or General Peritonitis.*—This usually results from leakage of the contents of the stomach or bowel into the cavity of the peritoneum. It almost invariably follows wounds or ruptures of hollow organs, but may proceed from infection through a penetrating wound that affects only the abdominal cavity. It may also follow from infection of blood poured out into the abdominal cavity after injury to a solid organ.

Any of the above accidents may cause widely-spread formation of matter (pus) in the peritoneal cavity, and this will be invariably fatal unless immediately operated on. Operation often fails to cure, especially if there has been any delay.

(b) **Intestinal Obstruction** may occur at any time after an attack of peritonitis, through the contractions from the adhesions or snaring of a loop by an old band that a degree of narrowness is produced which is too great to allow of the passage of the bowel contents.

#### 2. Existing before the Accident and accentuating its Effects.—

(i.) Tuberculous peritonitis.

(ii.) Disease of the appendix.

(iii.) Disease of the Fallopian tubes.

(iv.) Old peritoneal adhesions.

(i.) **Tuberculous Peritonitis** is a common disease, especially in children. It may exist as a local condition, and become generalized as the result of an injury.

(ii.) **Disease of the Appendix** is common, although the patient is often unconscious of his condition. After a long period of quiescence, it may as the result of an injury become active and serious, and spread to the adjacent peritoneum. (See Appendix.) [Figs. 2, 9, 10.]

(iii.) **Disease of the Fallopian Tubes**, an exceedingly prevalent disease, in the same way may wake into activity as the result of an abdominal injury, and even infect the peritoneum, though this is very common without injury at all. (See Injuries to the Genital Organs—Female.) [Figs. 82, 85, 86.]

(iv.) **Peritoneal Adhesions**.—As the result of a strain a part or whole of some of the bowel may be driven into a pocket or loop already formed by adhesions in the abdomen. This produces an internal rupture. The bowel may then become obstructed, and the patient suffer from all the consequences of intestinal obstruction. [Fig. 113.]

### Operation.

**Peritonitis**.—General diffuse peritonitis is a rapidly fatal disease unless treated by early operation, and even under these conditions death not infrequently results. Operation consists in dealing with the cause of the peritonitis—*e.g.*, the rupture or wound of a hollow organ—and in providing for draining away any fluids formed.

In local peritonitis operation is rarely called for unless an abscess results.

**Acute Intestinal Obstruction**.—This is invariably fatal unless treated by early operation; the danger is enormously increased by delay. Operation consists in removing the cause—*e.g.*, by cutting away the adhesions, and sometimes in opening and draining the bowel.

**Adhesions**, the result of peritonitis, which are causing symptoms may be dealt with by opening the abdomen and dividing them. It is an operation attended by little risk in the hands of a surgeon used to abdominal operations.

### Cure.

Local peritonitis due to slight injury should be cured in under a month. If an abscess has formed, cure will be delayed until it has ceased to discharge and the wound is soundly healed. No time can be given for cure in the case of diffuse peritonitis or intestinal obstruction, as the conditions which produce them vary so much. (See Abdomen and Intestine.)

After an operation for the division of adhesions, to relieve pain following an abdominal injury, cure is by no means certain. The adhesions may re-form, or the patient may still complain of the same pain and discomfort.

Adhesions are always liable to give rise to the minor symptoms of pain and discomfort in "nervous" individuals.

### Return to Work.

After local peritonitis, in under six weeks the patient should be able to perform any kind of work. But he may be incapacitated for a much longer period if an abscess requires to be opened and drained. In this case the patient should be fit for work one month after the wound has healed, but the same factors—*e.g.*, ventral hernia—come into play as after other abdominal operations. (See Rupture—Ventral Hernia, p. 693.)

The pain and discomfort due to the presence of adhesions may prevent the patient from doing even the slightest work. After general diffuse peritonitis, the patient, under the most favourable circumstances, may be able to return to work in three months from the date of operation. But usually a much longer time is necessary, and it is by no means uncommon to find that the patient is permanently incapacitated from doing any heavy work.

After an operation for the division of adhesions, the patient should be able to return to work within two months of operation. But it must be remembered that the operation is by no means always a success even in individuals in whom there is no question of compensation. No operation should be recommended unless the symptoms point to the pain or discomfort being definitely due to adhesions. Operation should not be undertaken simply because a patient complains of pain following an abdominal injury.

In these cases it is extremely difficult to give a fixed period at which work may be resumed.

### Recurrence.

As the result of peritonitis, there is always the chance of intestinal obstruction recurring, as adhesions constantly re-form after they have been treated by operation.

### Occupation.

No occupation carries with it any special risk of peritoneal injuries.

**Diagnosis.**

After an abdominal injury, the question of diagnosis will only arise when pain is complained of, which may be due to adhesions produced as the result of the accident. In many cases no definite opinion can be given where pain only is complained of. The pain may be due to adhesions if associated with a definite train of symptoms due to interference with the functions of any abdominal organ, but in most cases a positive opinion cannot be given until after operation, and perhaps not then. (See Abdomen, p. 47.)

**Malingering.**

Pain following abdominal injuries is the malingerer's opportunity. There is no means to enable us to form a just opinion of his case, by which he can be controverted if the alleged pain is the only symptom of which he complains. (See Abdomen.)

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*For legal cases of Injury to the Peritoneum, see CASE GUIDE :  
Peritoneum.*

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**PHOSPHORUS.**

*See* POISONS—PHOSPHORUS.

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**PHTHISIS.**

*See* LUNGS.

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**PITCH.**

*See* SKIN.

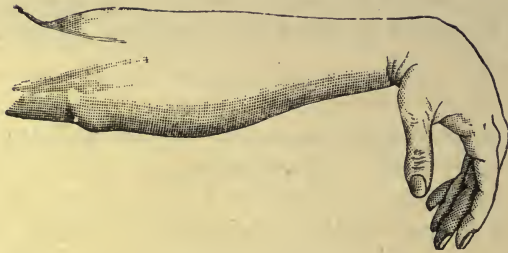


FIG. 154.—WRIST-DROP, CAUSED BY PARALYSIS OF THE NERVES TO THE  
EXTENSOR MUSCLES OF THE WRIST IN LEAD-POISONING.

(From Rose and Carless's "Surgery.")



## POISONS.\*

By FRED J. SMITH,

M.D. (OXON.), F.R.C.P. (LOND.), F.R.C.S. (ENG.),

Lecturer on Medical Jurisprudence at the London Hospital; Medical Referee to the Home Office; Editor of "Taylor's Medical Jurisprudence."

### ARSENIC.

#### Head-note.

The chief danger from arsenical poisoning is, if acute, death; if chronic, or prolonged over some time, nerve troubles.

#### Technical Terms.

*Arsenic.*—Literally, the element arsenic, but usually the name for the oxide, "white arsenic," which is a white, tasteless powder, and the commonest commercial form of arsenic.

*Arseniuretted Hydrogen.*—An extremely poisonous gaseous compound of hydrogen and arsenic.

#### Distribution in Nature, etc.

Arsenic is an exceedingly common metal; it is found in minerals combined with other metals or combined with other elements, of which sulphur is perhaps the commonest.

Industrially, when the word "arsenic" is used, it does not necessarily mean metallic arsenic, but some compound of arsenic.

The following are the commoner trade compounds:

*White Arsenic (Oxide of Arsenic)* is a white powder which is capable of being diffused into the air (sublimated) at temperatures which are not very high. It is used in rat-paste, fly-papers, etc.

*Pigments.*—Scheele's green and emerald-green, which are compounds of copper and arsenic.

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\* Poisons included in the Third Schedule of the Workmen's Compensation Act, 1906.

*Orpiment*.—A combination of sulphur and arsenic.

*Arseniuretted Hydrogen*.—This is an accidental product which is occasionally given off in trade processes, in consequence of heating metals containing arsenic to high temperatures.

*Arsenic Di-ethylamine*.—This is a compound produced by the action of certain moulds in the presence of arsenic. It is volatile and is the form of arsenic which is usually responsible for arsenical poisoning from such sources as wall-papers.

As with lead, so with arsenic. All processes involving the use of arsenic or its preparations or compounds are included in the Act; and though it is probable that the number of people working with known arsenical materials is much smaller than in the case of lead, there are one or two points about arsenic that make it probable that the actual number of those who are affected by arsenic is greater than of those injured by lead. For the one thing, the metal would seem to be more widely distributed in Nature than is lead; witness the curious places in which it has been found—*e.g.*, in malted barley (J. Hutchinson). Again, it is a much lighter metal, and therefore can the more easily be carried about in dust. Then, too, it is volatile at temperatures at which lead would be quite unaffected, and is, moreover, capable of forming gaseous compounds—a power not possessed by lead.

### Consequences of Poisoning by Arsenic.

Arsenic may affect the skin, the alimentary canal, or the nervous system, and in the form of arseniuretted hydrogen may produce a very serious train of symptoms: "Shivering, followed by weakness, headache, vomiting, and collapse; later, destruction of blood-corpuscles and jaundice." None of these symptoms, except the last rare trouble, are specific—*i.e.*, can off-hand be recognized as due to arsenic alone, and nothing else; hence a critical analysis of them would serve no useful purpose, as the ultimate test of whether they are so or not must be the presence of the metal in the urine. (For the effects of arsenic upon the skin, see Skin—Occupation Diseases, p. 750.)

### Disease.

1. **Produced by Arsenic**.—Unlike the case of lead, there is no evidence to show that arsenical poisoning can be very remotely followed by any sequelæ. The staining of the skin, it must be admitted, lasts for a very long time, but this has no

effect upon the working capacity of the affected person. So, too, when once peripheral nerves have been inflamed, as arsenic inflames them, a period of many months, possibly even two years or more, is required to effect a cure. The general symptoms of ill-health and anæmia soon disappear after accidental poisoning, or on ceasing to work in arsenic in the more chronic cases.

2. **Existing before the Poisoning and accentuating its Effects.**—There are no states of the body which are known to render a man more liable to be unfavourably influenced by arsenic in small quantities, and assuredly no human being can take a large quantity with impunity. Owing, however, to the similarity of the action of alcohol and arsenic respectively on the nerves of the body, it would be certainly wiser to forbid a man from working with arsenic who was known to have had alcoholic neuritis.

#### Operation.

In connection with arsenical poisoning there is no operation in ordinary practice.

#### Cure.

Usually rapid in the case of acute arsenical poisoning, but it may be very slow if the neuritis has been severe.

#### Return to Work.

As soon as complete cure occurs the man can return to work.

#### Recurrence.

There is no fear of recurrence except upon fresh exposure to the poison.

#### Occupation Diseases.

Workmen are liable to arsenical poisoning in the following trades :

##### I. *Metal-workers :*

- (a) White enamelling on metal.
- (b) Tinning sheet-iron.
- (c) Bronzing brass.
- (d) In obtaining silver from silver-bearing zinc ores.
- (e) In cleaning out flues of ore-calcining works, when the ore contains arsenic, or accidentally falling into the same.

2. *Taxidermists :*

The preparation of skins by preservatives into which arsenic enters by either a mixture of commercial arsenic and plaster of Paris as a powder or arsenical soap as a dressing. Even persons employed in shops where stuffed birds, animals, etc., are stored for the purpose of exhibition and sale may become poisoned.

3. *Marine Engineers :*

A solution of bicarbonate of soda and arsenic is used for the purpose of cleansing and the removal of furring from boilers, as follows: 40 parts white arsenic, 9 parts bicarbonate of soda, dissolved in water.

4. *Agriculturists :*

Farmers and labourers employed in sheep-dipping and cattle-washing with arsenical parasiticides, and steeping grain in arsenical solutions for preservative purposes. Even gardeners using weed-killers.

5. *Glassmakers.*6. *Fly-paper Makers :*

The making of fly-papers and vermin-killers containing arsenic.

7. *Makers of Glazed, Coloured, or Heavy Paper :*

Such as lamp-shades, fancy stationery, artificial flowers, glazed labels and playing cards, wrappers for tobacco, cigarettes, and sweets, cardboard boxes, coarse, heavy papers for floor-covering beneath carpets.

8. *Leather-workers :*

Glazing and finishing or colouring leather articles—e.g., hat-bands.

9. *Cotton-workers :*

Glazing or "putting a face upon" or colouring chintz, cretonne, cambric, calico, silk.

10. *Carpet-makers :*

Workmen employed in carpet factories and weaving, where arsenic or its compounds enter into any one process of the manufacture.

11. *Paint-mixers :*

Workmen manufacturing pigments, oil-paints, water-colours, paints, which may contain arsenic.

12. *Wall-paper Makers :*

Workmen in wall-paper manufactories where papers of a low grade are made.

13. *Rubber-workers :*

Makers of floor-cloths, rubber, linoleum, highly coloured toys, balls (indiarubber).

**14. Chemists :**

Workmen in the employ of manufacturing chemists, and men employed by wholesale druggists who handle arsenic in bulk for weighing and packing, etc.

**15. Dyers :**

Workmen employed when arsenic is used in the production of aniline dyes.

**Diagnosis.**

The inquiries closely follow those enumerated in the case of lead (*q.v.*, p. 632), but would also involve a more searching analysis, in home-workers at any rate, of all the articles used by the person when at work ; for very frequently arsenic is found to have crept into articles guaranteed free from it. And then, again, it may have gained access to the system from such an unsuspected source as the wall-paper of his living or bed room, or from aniline dyes on his under-clothing. Chemical analysis must not be accepted without close cross-examination as to the tests applied to all the re-agents used, to show that these were free from arsenical impurities.

**Malingering.**

Section 2 of the Act states that proceedings shall not be maintainable unless the claim has been made within six months, and then goes on to say that want of notice shall not be a bar, if the employer be not prejudiced in his defence by absence of such notice, etc. This section and its subclauses are of the utmost importance for the employer in cases where malingering is a possibility. For if it be alleged that a man is suffering from arsenical poisoning (say a shepherd who has been dipping sheep, or an agricultural labourer who has been steeping wheat in a smut-destroying solution), it is comparatively easy to say whether he is or is not suffering from peripheral neuritis ; but after the lapse of a few weeks it is absolutely impossible to state definitely whether this neuritis is or is not due to arsenic, for the only chance of an answer depends upon finding arsenic in the urine, nails, or hair, and after a few weeks' cessation from fresh introduction of the metal it is entirely eliminated from the body. Now, obviously, in resisting a claim an employer is seriously prejudiced by delay, which may eliminate the chance of finding arsenic in the claimant's body.

In this connection it is worth noting that arsenic always affects both motor and sensory nerves, a point which may serve

to distinguish it from mercury and lead, which commonly affect motor nerves only.

## CARBON BISULPHIDE.

### Head-note.

The great danger of carbon bisulphide is to the nervous system, particularly to the memory.

### Technical Term.

*Carbon Bisulphide* ( $CS_2$ ).—A liquid compound of carbon and sulphur, extremely offensive in smell. It is a remarkable solvent for such things as oils, fats, indiarubber, etc.

### Distribution in Nature, etc.

Carbon bisulphide is an artificial product.

### Consequences of Poisoning by Carbon Bisulphide.

These are exhibited almost entirely by the nervous system, and consist of (*a*) mental exaltation or depression, often indistinguishable from hysteria; (*b*) inflammation of the sensory and motor nerve endings, or, in less severe cases, headache, dizziness, etc.

### Disease.

1. **Produced by Carbon Bisulphide.**—Strictly speaking, as only the chronic form of poisoning is met with, all the symptoms should be arranged under the head (but see above, Consequences of Poisoning by Carbon Bisulphide). That this substance can and does produce changes in the brain which are permanent is its chief danger. Great and permanent mental deterioration (particularly, perhaps, in the memory) is the usual form it takes.

2. **Existing before the Poisoning and aggravating its Effects.**—There is nothing known about the influence of pre-existing disease on the effects of the poison.

### Operation.

None needed.

### Cure.

Follows spontaneously on removal to fresh air in the majority of cases, but is in a few cases incomplete.

**Return to Work.**

The workman is likely to be completely incapacitated for twenty-four to forty-eight hours in cases that recover ; in cases of permanent mental deterioration capacity for work is a matter of calculation in each case.

**Recurrence.**

Only on re-exposure to the fumes.

**Occupation Disease.**

Carbon bisulphide poisoning occurs most frequently in the following trades :

1. Indiarubber works.
2. Guttapercha works.

**Diagnosis.**

The substance is used amongst such a small community that there should be no difficulty in ascertaining the facts of any given case ; the stuff is never (what one may call) a " Casual Inhabitant " of shops or other places, nor should it be used at home by workpeople.

**Malingering.**

It is just possible that attacks of hysteria might be alleged to be due to poisoning by this substance ; such attacks would require close cross-examination as to time of onset, duration of work, etc., to separate them from the effects of poisoning.

**CHROME ULCERATION.**

This is a special example of corrosive fluids and dust in general. The Committee inserted it in the schedule on the grounds that cause and effect were distinctly established in the trade.

**Head-note.**

The danger of chrome-poisoning is, chiefly, perforation of the cartilage (nasal septum) which separate the two nostrils.

**Technical Terms.**

*Bichromate of Potash.*—Orange-yellow crystals, soluble in water, used as a dye.

*Chromate of Lead.*—A yellow powder used as a paint.

*Chromium.*—The pure metal which is never used in this condition.

### Distribution in Nature, etc.

The principal trade product is bichromate of potassium, which is very largely used in arts and sciences, and is an artificial product chiefly manufactured from the natural yellow chromate of lead.

### Consequences of Poisoning by Chrome.

Chrome solutions and chrome dust appear to differ from the other corrosives from the fact that their action is not immediate in point of time, for they require a constancy of exposure to produce an effect known as "chrome hole," a sluggish ulcer of the septum of the nose, with characteristically undermined and thickened edges. Where in the manufacture of crystals the dust is inhaled for long, the septum of the nose generally becomes actually perforated. (See Nose, p. 592.)

### Disease.

1. **Caused by Chromium.**—The sores themselves are very chronic and slow to heal, but once healed no further troubles need be expected, save those incidental to all scars.

2. **Existing before the Poisoning and aggravating its Effects.**—It would appear that there are really none known, for even the skin or nose will break down if only the exposure be prolonged; but a sore or crack in the skin is undoubtedly much sooner and more easily affected than a healthy surface.

### Operation.

None required.

### Cure.

May be slow owing to general ill-health. (See Nose, p. 595.)

### Return to Work.

The ulceration itself causes no diminution in working capacity, but the workman affected should cease from the particular work until healing is complete—a very variable period of time.

### Recurrence.

Only on re-exposure.

### Occupation Diseases.

#### I. *Chemists* :

Workmen in factories making bichromate suffer very markedly from the irritant effects of the chrome dust (whether it is chromic acid or chromates).



2. *Dyers :*

Potassium bichromate, or "red crystals," are used in (1) dye-works ; (2) wood-staining.

Chromate of lead, used to dye an orange-yellow.

Textile operatives have contracted chrome and lead poisoning from making orange-coloured cloth.

3. *Yarn-combers :*

Also yarn-combing and handling, and the consequent inhalation of dust, has caused lead and chrome poisoning.

This poisoning is a complex one, the sufferer being poisoned by lead and by chrome.

**Diagnosis.**

The infection arises directly from the employment, so that the usual lines of inquiry would be necessary, not forgetting the possibility of syphilis acquired or inherited.

**Malingering.**

The Departmental Committee remarks that the lesion can be distinguished without difficulty, and in a previously healthy subject this is probably true; but if a workman has been previously infected with syphilis, a difficulty might easily arise in estimating the share which this disease had taken in producing ulceration.

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GONIOMA KAMASSI, OR AFRICAN  
BOXWOOD.

**Head-note.**

The greatest danger is sudden heart failure.

**Effects of Poisoning from Gonioma Kamassi.**

Recurring attacks of headache, coryza, lachrymation, and asthma-like seizures, followed by heart failure, led to an investigation of the nature of the wood used, and it was found to be of an extremely poisonous character.

The disease is too rare to require further notice here, for the industry—shuttle-making—is a small one, and probably other woods will be found capable of taking the place of gonioma.

## LEAD.

**Head-note.**

The consequences of lead-poisoning are paralysis of the nerves of the muscles of the forearm, "wrist-drop."

The metal may also affect the brain, producing a very dangerous condition.

**Technical Terms.**

*Lead Encephalopathy.*—Lead-poisoning of the brain.

*Plumbism.*—Lead-poisoning.

**Distribution in Nature, etc.**

Lead is found in Nature as the sulphide, oxide, etc. Industrially it is largely used in a nearly pure state as a metal, and its commonest salts are the carbonate, or white lead, and the red oxide, or red lead.

Many paints are salts of lead, especially the carbonate, mixed or not with some colouring matter. The silicate is commonly used as a glaze for pots.

**Consequences of Poisoning by Lead.**

The method of absorption of lead may be through—

- (a) The alimentary canal (about 90 per cent. of the cases).
- (b) The lungs, from lead in dust.
- (c) The skin, possibly when lead is allowed to accumulate under the nails or in the hair, etc.

The known immediate effects of lead on the system may be thus enumerated :

1. It may affect the blood, leading to a condition of anæmia.
2. It may affect the alimentary system, leading to colic and constipation, frequently associated with a blue line on the gums, loss of appetite, and a sweetish, metallic taste in the mouth.
3. It may affect the nervous system, leading to (a) wrist-drop or other forms of paralysis of groups of limb muscles; or (b) an affection of the brain associated with fits or mental disturbances, most frequently progressing to a fatal termination in coma.

But it must not be assumed at once that any one of these symptoms when present in a claimant is due to lead, and that

only; nor, indeed that all of them when present together incontestably prove lead-poisoning; though it must be admitted that if a person presented them all, and was a known worker in lead, the presumption in favour of lead as the cause would be so strong as to be irresistible, even though the person were a young girl, in whom the combination of severe indigestion, anæmia, and hysterical nervous phenomena, is by no means infrequent.

### Disease.

1. **Caused by Lead.**—While, on the one hand, it seems but fair that a workman whose wage-earning capacity has been damaged by an occupation disease should be recompensed, it is, on the other hand, reasonable to put a time limit to a master's liability. The Act has used the word "sequelæ" without any qualifying adjective, a use of words which I feel may lead to a good deal of trouble; for the sequelæ of all diseases may be divided into temporary and permanent, or recoverable and irrecoverable, and in lead-poisoning this contrast is as marked as in any, or even more so.

The colic and the blue line on the gums may, and probably will, disappear within a few weeks at the outside, and so, too will the constipation, with a little care and attention on the part of the patient; the affections of the nerves of the limbs usually improve in a few months, and may disappear entirely, though they do not always do so. The affection of the brain, on the other hand, if it be not rapidly fatal (the commoner event), will in all probability result in permanent deterioration of the brain power; and an affection of the kidneys started or aggravated by plumbism may certainly produce a condition totally irrecoverable so far as a *restitutio ad integrum* is concerned, but which may remain without appreciable progress and without manifest disability, or, on the other hand, may slowly progress downwards for years, to end in ultimate death a decade or more after lead work has been given up.

2. **Existing before the Poisoning and aggravating its Effects.**—A previous habit of constipation must be considered to predispose to the absorption of lead into the system, for it is mainly or at least most commonly by the mouth that lead is admitted to the system, and by the rectum that the metal is got rid of from the system.

In addition to constipation, the only other known factor is functionally damaged kidneys, for this is the only other channel through which the metal is eliminated; hence persons who are

known to have had gout (the kidneys are seldom quite sound in this disease), or an attack of inflammation of the kidneys, may be expected to suffer more easily from lead-poisoning than other individuals; but it must be admitted that there are some unknown factors at work, for it is beyond all question that lead-poisoning shows itself earlier and more severely in some people than in others who are in every known way equally healthy. Finally, it must be taken for granted that, if lead be continuously admitted in small quantities to the system, every single individual so treated will sooner or later show the evil effects.

#### Operation.

None applicable.

#### Cure.

Gradual, but can be hastened by purgatives, etc.

#### Return to Work.

So soon as the nerve weakness has disappeared the workman can return to work. This should be in a period which will average two months from the commencement of cure.

#### Recurrence.

Only on re-exposure, when the poisoning is more likely to affect the man again.

#### Occupation Diseases.

Painters. Plumbers. Electric-light workers in accumulator works; japanners; earthenware glazers (dippers); enamellers of iron plates; textile operatives dealing with yellow-dyed clothes or yarn-combing and folding of dyed wool (bichromate of lead). Any worker who comes regularly in touch with metallic lead, *e.g.*, smelters; compositors; workers capping bottles for pickles, etc., with leadfoil, folding tobacco, etc.; file-cutters (files before the cutting are embedded in lead). Sailors (the last few weeks before entering port all hands paint the ship; lead-poisoning is then frequent).

#### Diagnosis.

The lines of inquiry in a case disputed in court must be mainly—

1. That the claimant's work does bring him frequently or continuously in contact with lead or its compounds.

2. That the symptoms of which he complains are known to be at times caused by lead.

3. That there are incontestable proofs of lead being in his system by administering magnesium sulphate and iodide of potassium, and then having a critical analysis made of his urine and fæces for lead.

4. That there are weighty reasons pointing to the exclusion of other sources than his work, remembering the proverbial difficulty of proving a negative.

5. Careful estimation of the degree of deterioration in the wage-earning capacity of the claimant, bearing in mind the strong probability that he must be totally excluded from work involving contact with lead compounds.

### Malingering.

Amongst lead workers the symptoms of lead-poisoning are well known, and it is possible that from time to time cases of malingering may occur. The alleged presence of pain can hardly be tested except by general considerations of a comparison between the severity as alleged and the outward expression of the same; various forms of paralysis may have occurred from other previously existing causes, and may now be alleged to be due to lead. If such cases do arise, they will be difficult to detect if no medical examination of the workman has been made previous to his entering on lead work. Obviously, the fact of the paralysis must first be established, and then its dependence upon lead must stand upon (1) evidence of its non-existence previously, and (2) critical chemical examination of urine and fæces. Commonly, however, the malingering (if it can be so called) is the other way about, the workman endeavouring to show that the symptoms of which he complains are not due to lead; for if they are deemed to be so by the certifying factory surgeon, the workman will or may be forced to abandon an occupation associated with good wages. There is no need amongst lead workers to consider the alternative modes by which lead might gain access to the system, which occasionally in ordinary medical practice give rise to much difficulty in diagnosis. The reason is obvious, because, with so much contact with lead when at work, the possibility of the beer pipe, etc., will be ignored in comparison, even if suspected.

## MERCURY.

Mercury-poisoning and its sequelæ are scheduled under the Act.

**Head-note.**

The great danger of industrial mercurial poisoning is ulceration of the gums and tremor of the muscles.

**Technical Terms.**

*Vermilion.*—Sulphide of mercury.

**Distribution in Nature, etc.**

Pure metallic mercury, the metal of the thermometer, is widely used industrially. Alloys of mercury with other metals are common in electrical works. Numerous pigments, of which, perhaps, vermilion is the commonest, are also compounds of mercury. Vermilion is found naturally in the mercury mines.

**Consequences of Poisoning by Mercury.**

In cases of excessive medicinal dosage these are fairly characteristic, and consist of soreness and tenderness of gums and teeth, with excessive secretion of saliva; but in industrial mercurialism they rarely occur in this form purely, but are characterized by tremor of the muscles, which is at first emphasized by attention being drawn to it, as though there were a mental element in the case. Later the tremor becomes more marked and constant, and less influenced by the mind.

The diagnosis must rest upon the tremor in association with the occupation, and also with some gum and teeth symptoms.

**Disease.**

1. **Caused by Mercury.**—No remote sequelæ are to be feared from mercury, unless, indeed, the factory surgeon has been very remiss in permitting an affected workman to continue at work too long.

All incipient or mild cases recover completely within a few months at the outside; there is no evidence to show that mercurialism leads to permanent degeneration of the nervous system.

2. **Existing before the Poisoning and aggravating its Effects.**—Judged by one's experience of administering mercury medicinally, it is certain that some people are more easily affected than others; but we are absolutely in the dark as to

the reasons why, so that no estimation of predisposing factors is possible, but certainly no person with known nervous disease should be allowed to work at a mercurial occupation.

#### Operation.

None conceivable.

#### Cure.

Generally a matter of a few weeks.

#### Work.

The tremors certainly diminish a man's working capacity materially, and he should not be allowed to continue at work until recovery is established.

#### Recurrence.

Only on re-exposure.

#### Occupation Diseases.

All workers who come into contact with mercury or its preparations are liable to poisoning. Classes affected: Miners in quicksilver-mines. Looking-glass makers—formerly less. Thermometer and barometer makers. Any other class employing mercurial preparations, such as nitrate of mercury; bronzers and fumers, and the hat trade.

#### Diagnosis.

In a disputed case, the points upon which the diagnosis will rest will be more clearly defined than with the metals we have previously discussed, owing to the absence of accidental causes for mercurialism; but obviously they must be, broadly speaking, in the same direction, viz.: (1) the fact of phenomena, possibly due to mercury, being present; (2) the proof that mercury does or does not enter into the substances used by the workman.

A mercurial tremor has fairly characteristic points of its own; so, too, on the other hand, have the tremors of such diseases as paralysis agitans, disseminated sclerosis, Graves' disease, etc.; and the positive and negative features on each side should serve to detect the nature of the case.

#### Malingering.

The only conditions under which it is possible to imagine a case of malingering is that of a man already suffering from

some chronic sclerosis of cord or brain which produces tremors claims that his condition was induced or aggravated by mercury. On this it may be said that no such case is on record, though one must admit the possibility of one some day occurring.

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### NICKEL CARBONYL.

Only twenty-five cases, three of which were fatal, of poisoning by this gas have occurred, and these all in one factory (the only one in England for obtaining nickel). It is too local a trouble and too fixed and definite in its occurrence to need discussion.

No cases have occurred recently, the process being so carefully watched and safeguarded.

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### NITRO AND AMIDO DERIVATIVES OF BENZINE.

#### Head-note.

Destruction of the blood and affection of the nervous system are the two chief dangers from these poisons.

#### Distribution in Nature, etc.

The poisons are entirely artificial products, being made from benzine.

#### Consequences of Poisoning by Nitro and Amido Benzine.

The poisons act by absorption into the blood, and then acting upon the blood after such absorption.

The poison is very volatile, and is readily absorbed through the lungs.

The poisoning may incapacitate a workman for weeks or months owing to degeneration and destruction of the red corpuscles in the blood, and to the action, in severe cases, on the nervous system, whereby muscular atrophy may result.

#### Disease.

I. **Produced by the Accident.**—The benzine derivatives appear to leave no permanent sequelæ behind when the destroyed blood is once replaced.



2. **Existing before the Poisoning and aggravating its Effects.**—None seem to be known, though the degree of effect varies amongst a group of workmen.

#### **Operation.**

None conceivable.

#### **Cure.**

This may take some weeks, or even months, if the action of the poison has been prolonged.

#### **Return to Work.**

A person suffering from the poison should not be allowed to continue at the work so that incapacity in this particular work is complete, but capacity for other work may be but little diminished.

Return to work is permissible as soon as the man is cured.

#### **Recurrence.**

A man who has once been cured will not suffer from any after-effects or risk of recurrence.

#### **Occupation Diseases.**

Workers in dye-works and persons handling aniline-oil and its derivatives are liable to the trouble.

#### **Diagnosis.**

The lines of inquiry to establish a diagnosis are solely of the ordinary variety of proof of occupation and of the substance being in the blood, with just the one additional point that occasionally cases are reported of severe trouble arising from the absorption of aniline dyes through the skin from the marking of underwear. This source of the trouble must therefore be excluded.

#### **Malingering.**

The peculiar leaden colour of the lips of a victim cannot be artificially produced; the blood-changes induced by the poison can be detected with certainty, so that only the headache can be imitated, or rather alleged to be present when it is not.

## NITROUS FUMES.

**Head-note.**

The danger lies in the poison acting fatally after an interval of apparent recovery.

**Technical Terms.**

*Nitrous Fumes.*— $N_2O_3$  and  $N_3O_4$  are two of the combinations of nitrogen and oxygen. They are orange-coloured vapours.

**Distribution in Nature, etc.**

Nitric acid is used and developed in enormous quantities in certain chemical processes, and the essential point in which it differs from sulphuric acid is in its volatility, being highly volatile at ordinary atmospheric temperatures. Consequently, whenever the acid is present in bulk in open vessels a very dangerous atmosphere, highly charged with acid fumes, is created; and should a workman breathe this atmosphere for more than a moment or two, a fatal illness may arise, for which it is but right that compensation should be paid.

**Consequences of Poisoning by Nitrous Fumes.**

All are liable to be affected who are exposed to the fumes, and that, too, in proportion to the duration of exposure.

These are identical with those of an acute, exceedingly severe bronchitis, rapidly leading to extreme difficulty of breathing. If the exposure has been of some duration, death is almost certain, though some hours commonly elapse between death and the removal from the fumes.

**Disease.**

1. **The Consequence of Nitrous Fumes.**—Should recovery ensue, there can be but little doubt but that there is likely to remain an increased liability to bronchitis from ordinary causes; but there is no evidence to show that ill-health, in the ordinary sense of the word, occurs as the direct result of repeated very short exposures.

2. **Existing before the Poisoning and aggravating its Effects.**—Lung diseases of any kind would probably be aggravated by nitrous fumes.

**Operation.**

None possible.

**Cure.**

No special time can be fixed.

**Return to Work.**

The man's incapacity for any work is complete during the acute illness, but when he is cured he may resume work.

**Recurrence.**

There is no risk of recurrence after cure.

**Occupation Diseases.**1. *Acid Manufacturers :*

Manufacturers' workmen employed in the making of acids in bulk.

2. *Chemists :*

Laboratory assistants and others.

3. *Brass-founders.***Diagnosis.**

The lines of inquiry are at once obvious in a general sense, but difficult to express in particulars, so much depending on matters of fact as to the dates of the trouble in reference to duration, etc., of employment.

**Malingering.**

In the case of gassing by nitrous fumes there is very little chance of malingering ; for though the trouble may not follow immediately on the exposure, it is very characteristic when it does occur. So much is this the case that in the second column of the schedule has been inserted "any process in which nitrous fumes are evolved," thus throwing on the employer the burden of proof that it did not so arise.

## PHOSPHORUS.

**Head-note.**

The danger of phosphorus-poisoning is destruction of the bone of the jaw, liver disease, and fatty degeneration of the organs.

### Technical Terms.

*Nēcrōsīs*.—Gradual death of bone in fragments visible to the naked eye.

*Phosphorus*.—A non-metallic element which occurs in two forms: (1) The yellow, wax-like sticks which fume in air, and have to be kept under water, and is highly poisonous; (2) the red or amorphous, a harmless, non-poisonous red powder.

### Distribution in Nature, etc.

There can be no doubt about the propriety of scheduling "any process involving the use of phosphorus," if by that term is meant the ordinary yellow variety, for the great and peculiar dangers involved in handling this are well known; but there is practically no danger in handling the red variety, and the compounds of phosphorus (except those which are vapours) have no special dangers inherent in the fact that they contain phosphorus. The Act in this case seems to be unnecessarily strict.

### Consequences of Poisoning by Phosphorus.

Acute phosphorus-poisoning consists of severe abdominal symptoms, vomiting, and pain, often followed by a delusive period of quiescence and apparent recovery for a week or so, with a second illness closely resembling acute yellow atrophy of the liver. Upon the exact pathology of, or internal sequence of events leading to, chronic poisoning, or "phossy jaw," there is still some scientific doubt; but the anæmia followed by severe toothache, and eventuating in progressive necrosis, constitute together a picture unmistakable in its evidence.

### Disease.

1. **Produced by Phosphorus**.—Provided that phosphorus-poisoning has not gone beyond the state of simple anæmia, no sequelæ need be feared, and the trouble will clear up completely within a short time of relinquishing the work.

Stockman says necrosis is due to tubercle bacilli, which act as follows:

(a) The phosphorus fumes erode the bone and weaken its nutrition, thus providing a nidus for the bacilli.

(b) Absorption of phosphorus causes a general weakening of the bone.

(c) Idiosyncrasy or constitutional weakness, and a breach of surface with decayed teeth, as not all workers with bad teeth are affected, only some.

2. **Existing before the Poisoning and aggravating its Effects.**—None are known as regards the acute form. Whatever may be the pathology of the chronic form, it is established beyond any doubt that carious teeth are a most important predisposing factor in inducing it; and it is quite certain that anyone who has a carious tooth in his head, even if well stopped, should not be allowed to work in a factory in which yellow phosphorus is used.

### Operation.

Sooner or later in the chronic cases there is sure to be loss of bone, perhaps necessitating an operation, and during the period in which the bone is dying and separating lardaceous disease of organs may arise.

### Cure.

Necrosis of the jaw is very slow, and no time for cure can be given.

Liver disease is usually fatal.

### Return to Work.

When cured.

### Recurrence.

There is no risk of recurrence.

### Occupation Diseases.

#### 1. *Matchmakers :*

This was previous to the employment of amorphous phosphorus, as it is the yellow form only which caused necrosis of the bones of the lower jaw. More rarely the upper jaw is affected.

#### 2. *Chemists :*

Manufacturing rat pastes and vermin destroyers.

### Diagnosis.

The only lines of claim and defence are the general ones of occupation and the fact of necrosis.

### Malingering.

There are no means of detecting the precise cause of a given case of necrosis of bone without the willing co-operation of the patient in revealing syphilis or other constitutional affection which might account for it; and if in a given case phosphorus

exposure can be proved, it will be so difficult to prove that it was *not* the phosphorus that caused the necrosis, that virtue must be made of the necessity of admitting that it probably was the phosphorus in an alleged case of "phossy jaw."

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*For legal cases of Poisoning, see CASE GUIDE: Poisons.*

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## POTASSIUM AND OTHER ALKALIES.

*See* SKIN.

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## PREGNANCY, ACCIDENTS DURING.

*See* GENITAL ORGANS—FEMALE.

# PRESERVATIVES AND ADULTERANTS IN FOOD.

By DAVID SOMMERVILLE,

B.A., M.D., D.P.H., M.R.C.P., F.C.S.,

Lecturer in Public Health, King's College, London.

## Head-note.

THE danger which arises from the presence of preservatives and adulterants in food is twofold :

1. The preservative itself is usually harmful to the human body.

2. Micro-organisms of disease, which are often present in food, especially milk, grow and multiply concurrently with the organisms of putrefaction and decomposition. Whilst the use of mild preservatives may prevent the multiplication of the organisms of putrefaction, the microbes of disease at the same time may escape destruction.

So decomposition is an indication and danger-signal of the growth of both kinds of micro-organisms. Now, preservatives, by preventing decomposition of diseased food, deprive the consumer of this danger-signal.

## Technical Terms.

*Ālūm.*—A double sulphate of aluminium and potassium, as used in dried meats and fish.

*Ānīline.*—Numerous aniline coal-tar dyes, used for colouring dairy products, meat, sausages, jams, jellies, sugars, confectionery, wines, and condiments.

*Ānnāttō.*—A yellow vegetable preparation derived from *Bixa orellana*, used for colouring milk and butter, especially in the winter season. Annatto is found in pickles and mustard to which starch has been added as an adulterant. It is added to dark cheese.

*Bēnzōic Acid.*—The acid exists in gum benzoin, several aromatic gums, etc. White, pleasantly-smelling crystals. Used in preserved fruits, sweet wines, syrups, and beer.

*Bi-carbonate of Soda.*—Used to diminish the acidity of decomposing milk.

*Borax.*—Sodium bi-borate. Used in milk, cream, butter, margarine, meat, fish (fresh and dried), sausages, potted meats, preserved fruits, and syrups.

*Boric Acid.*—White crystals slightly soluble in cold water. Used in the same manner as borax.

*Cochineal.*—A dye extracted from the cochineal insect. The dye is found in preserved fruits, jellies, jams, and syrups.

*Colouring Matter.*—Since the discovery of the aniline dyes the numerous mineral salts which formerly were engaged for colouring food-stuffs have practically disappeared, oxide of iron and sulphate of copper alone remaining.

*Condy's Fluid.*—A form of permanganate of potassium in water.

*Copper Sulphate, or Blue Stone.*—Used as colouring matter in preserved vegetables, especially peas.

*Fluorine.*—Compounds of fluorine have been detected in butter and cream.

*Förmälän (Förmic Äldēhēde).*—Used in milk, cream, meats, fish (fresh and dried), and British wines.

*Iron Oxide.*—See Colouring Matters.

*Lime.*—Used in butter and margarine.

*Logwood.*—Used in poor wines to produce a red tint.

*Permanganate of Potassium.*—Used to wash offensive meat.

*Peroxide of Hydrogen.*—Has been employed to destroy bacteria in milk.

*Potassium Nitrate.*—Saltpetre. Used to fix the colouring matter of vegetables, and also as preservative in dried foods, meat, and fish.

*Sälicylic Acid.*—Used for like purposes as borax and boric acid. Common in British wines.

*Saltpetre.*—See Potassium Nitrate.

*Silicates.*—Eggs are preserved by painting the shells with a solution of silicates.

*Sulphites.*—Used as borax and boric acid; also much used in beer.

*Tin, Chloride of.*—Has been employed to colour beet-sugar, so as to make it resemble Demarara sugar.

### Foods and their Preservatives.

In the following description of the preservatives mixed with foods we omit sugar, which is the commonest preservative, and salt (sodium chloride); for with rare exceptions salt is easily detected by the consumer, and is principally used for dried foods. To this milk is the one exception, for a little salt is sometimes added to milk to "freshen it up."



The following are the principal foods which are treated by "food preservatives," with the commoner substances used to preserve and colour them :

Anchovies	...	...	Oxide of iron.
Beer	...	...	Benzoic acid, sulphites.
Butter	...	...	} Borax, boric acid, formalin, lime, salicylic acid, and sulphites. An- natto and Aniline Dyes.
Cream	...	...	
Cocoa	...	...	Oxide of iron.
Cheese	...	...	Colouring matter (annatto).
Cured fish and meat	...	...	See Dried fish and meats.
Confectionery	...	...	Aniline dyes.
Dried fish and meats	...	...	Alum, borax, boric acid, formalin, salt, saltpetre, sulphites, aniline dyes.
Eggs	...	...	Silicates.
Fish, fresh	...	...	See Meat, fresh.
Fish, dried	...	...	See Dried fish and meats.
Fruits, preserved	...	...	Benzoic acid, boric acid, borax, salicylic acid, aniline dyes.
Ham	...	...	See Dried meat.
Jams	...	...	} Aniline dyes and cochineal.
Jellies	...	...	
Margarine	...	...	See Butter and Cream.
Meat, dried	...	...	See Dried fish and meats.
Meat, fresh	...	...	Boric acid, borax, formalin, per- manganate of potassium, salicylic acid, sulphites.
Milk	...	...	Boric acid, borax, bi-carbonate of soda, sulphites, permanganate of potassium, formalin, peroxide of hydrogen, salt, and sulphites.
Mustard	...	...	Annatto.
Pickles	...	...	Annatto.
Sauces	...	...	Oxide of Iron.
Sausages	...	...	Dried fish and meats.
Syrups	...	...	See Fruits, preserved.
Sugar	...	...	Tin chloride.
Vegetables	...	...	Colouring matters, copper sulphate. See Fruits.
Wines, British	...	...	Logwood.

### Action on the Human Body.

The intention of this section will perhaps best be fulfilled by briefly stating what is known concerning the influence on health of the principal preservatives in use at the present time. At the outset it may be mentioned that, through lack of experimental evidence, no more unsatisfactory chapter in preventive medicine could be selected for treatment.

When left in contact with the air, moisture, and a certain degree of heat, all dead matter, animal and vegetable, sooner or later putrefies—that is, undergoes a series of chemical changes.

The result of these changes is the transformation of the highly complex organic molecules into simpler and stabler compounds; in short, in the language of the chemist, such matter is ultimately oxidized, and thereby rendered harmless. At certain stages in the process of decomposition poisonous or toxic bodies of unknown composition appear, capable of producing, when swallowed, fatal results in man. Such bodies have doubtless been the cause of a very large number of cases of so-called “ptomaine-poisoning.” The active agents in the production of putrefaction are bacteria. In the present state of our knowledge it is not clear whether poisons can be produced in meat, etc., apart from bacteria, but the balance of bacteriological analogy would seem to point to the conclusion that bacteria are necessary to the production of these poisons. (See Ptomaine-Poisoning, p. 660.)

Other specific types of micro-organisms cause corresponding specific infective diseases.

The object of adding preservatives to foods is to prevent the growth and development of the microbes of putrefaction and disease.

The following preservatives will now be discussed in their action on the human body :

- Benzoic acid.
- Bi-carbonate of soda.
- Boric acid and Borax.
- Copper sulphate.
- Fluorine compounds.
- Formalin.
- Peroxide of hydrogen.
- Salicylic acid and salicylates.
- Sulphites.

**Benzoic Acid.**—Benzoic acid, a natural constituent of various balsams and essential oils, arrests the process of digestion, and Koch and others state that its germicidal properties are greater than those of salicylic acid. It fails to produce toxic effects in doses of 10 to 15 grains.

It is excreted by the kidneys as hippuric acid. Whilst on the whole it is probably less objectionable than salicylic acid, its detection and quantitative estimation are more difficult.

**Bi-carbonate of Soda.**—No harm is done by the small quantity of bi-carbonate of soda used in foods, except that by neutralizing the acids it acts as a mask to old milk. (See Milk.)

**Borax and Boric Acid.**—The effect upon the human body of boric acid when mixed with foods has been the subject of laborious investigations. The experiments have been carried out on young animals, such as kittens, sucking-pigs, etc., and even on man; but the results are discordant—at least, this is the opinion which an unprejudiced observer will conclude on a review of these experiments. Digestion in the mouth, in the stomach, and in the intestines, has been separately examined, and although some observers find signs of disturbances to follow large doses of boric acid, on the other hand, the effects of smaller doses are not clearly marked. The most laborious experiments were attempted in America by Wiley upon a number of men who were daily given large doses of boric acid. His report on the results of taking boric acid was to discourage its use in articles of food. The whole of his experiments have been exhaustively criticized by Liebrich, who concludes that the researches are valueless as a scientific determination of the precise effects of boric acid.

There is no doubt that when digestion of food is carried on under artificial conditions in a laboratory in the presence of boric acid and borax, moderate doses undoubtedly retard digestion, so that, as far as these experiments go, boric acid is a drug which should not be used in food.

**Copper Sulphate.**—This is a powerful germicide, and is used for the purpose of imparting a vivid green to certain foods. Kant, Tariessant, Lehmann, and Tschirch, have studied the action of copper salts on health, and conclude that the small quantities found naturally in foods, and the larger quantities introduced for the purpose of colour preservation, are incapable of exerting any harmful influence. When copper sulphate is added to green peas, or other green vegetables, a part combines with the green colouring matter (chlorophyll) to form

copper phyllocyanate, and the rest unites with the protein to form copper leguminate. Copper phyllocyanate is insoluble in water, and imparts the characteristic green colour to preserved vegetables. On extracting the phyllocyanate with chloroform or alcohol, the useless leguminate can be dissolved out in a weak watery solution of sodium hydrate, and the relative quantities of the two compounds can thus be estimated. Lehmann considers that so long as the total quantity of copper ingested does not exceed 1 decigramme per kilogramme of food, there can be no danger to health in consuming any vegetable in quantities not exceeding  $\frac{1}{2}$  kilogramme per person daily. Observers are not agreed concerning the quantity of copper that can be removed by the digestive juices. W. C. Williams was able to dissolve out 40 per cent. of the metal in peas by the action of artificial gastric and pancreatic juices in three hours. Spottiswoode Cameron recovered the whole of the copper from peas under practically the same conditions in twenty-four hours.

It is well known that copper is a poisonous metal, and that its compounds used for greening purposes are more or less soluble in the alimentary canal. Such being the case, it is obvious that its use should either be wholly forbidden or restricted to such small quantities that the most susceptible cannot be injured. More work is required to determine accurately the exact quantities which, under different conditions, may be accepted as harmless.

**Fluorine.**—Fluorine compounds have been met with as preservatives in butter and cream. The alkaline salts of fluorine to the extent of 0.02 per cent. inhibit digestion in the mouth and stomach (salivary and gastric digestion). The sodium salt greatly lowers blood-pressure. All compounds of fluorine should be rigorously excluded from foods.

**Formalin.**—Formalin is an excellent germicide, but is apt to disturb the gastric and intestinal digestion of milk. (See Milk.)

**Peroxide of Hydrogen.**—The effects of peroxide of hydrogen on the human body have not yet been recorded, but as it decomposes readily into water and oxygen, its use is probably harmless.

**Salicylic Acid and Salicylates.**—Salicylic acid is a powerful drug. Comparatively small quantities produce poisonous symptoms in certain individuals.

Further work must be done on the effects of the ingestion of salicylic acid and salicylates in foods before a definite pro-

nouncement be made with regard to their effect on health. The Departmental Committee suggested that salicylic acid, when added to beverages, should not exceed a grain per pint. This Committee might have gone farther and advised, as in the case of wines, the removal from commerce of all articles that, in order to be kept, require the addition of preservatives.

**Sulphites.** — Small quantities of sulphites (0·05 per cent.) inhibit bacterial growth; but the number of organisms found in a sample of meat depends on the original number present, and not on the quantity of the particular sulphite used. It is plain that no preservative can compensate for infected or improperly prepared meat. Sulphites are used to preserve or increase the red colour of meat by the formation and preservation of the red colouring matter of blood (oxy-hæmoglobin), and also to act as deodorants, whereby stale and malodorous meat can be made to appear fresh and sweet.

Harrington, Pfeiffer, Schultz, and others, have studied the action of sulphites on animals, and several observers have extended this study to themselves. The general conclusions drawn by these workers are that inflammatory gastro-intestinal and kidney changes follow the ingestion of sulphites.

**Foods which are frequently Adulterated with Preservatives.**

—The following foods are discussed with reference to their preservation with antiseptics and with the addition of colouring matters where these are used.

1. Milk:

- (a) What is milk, and what is pure milk?
- (b) Clean milk without preservatives or sterilization.
- (c) Preservatives used in milk: Boric acid, bi-carbonate of soda, salicylates, formalin, peroxide of hydrogen.

2. Cream.

3. Butter and margarine.

4. Meat and game:

- (a) Fresh meat and game.
- (b) Meats salted, dried, potted; sausages.

5. Fish:

- (a) Fresh.
- (b) Tinned.

6. Eggs.

7. Fruits, fresh and preserved.

8. Vegetables.
9. Alcoholic drinks:
10. Non-alcoholic drinks.

1. **Milk.**—(a) *What is Milk, and what is Pure Milk?*—Milk presents the strange contrast of being the most wholesome of all foods and at times one of the most dangerous. It is the most difficult food to preserve and handle in a pure state, in that it is an ideal medium for the growth of microbes. It is universally admitted that milk as at present supplied to our large cities is not a safe food. This is due to the indifference and ignorance of those engaged in the dairy trade, to the unclean and unhealthy cows used for producing milk, to insufficient cooling of the milk, to long transportation, to unnecessary and frequent handling, to lack of proper cleansing and sterilization of containing vessels; and to its frequent association with infectious disease. Microbes reach the milk from the teat, udder, and body of the cow; from the hands, body, and clothing of the milker; from the dust in the atmosphere; from particles of excrement or litter which enter the pail; from the pail itself, and from the water used to wash it. Of the numerous types of micro-organisms met with in milk, four are conspicuous:

(i.) *The Milk-souring Microbes (Lactic Acid Bacilli).*—These are the large group of bacteria which produce lactic acid from the sugar of milk, and cause the well-known curdling or souring. These microbes multiply rapidly when the temperature of the milk is allowed to rise to 150° F. (30° C.), but to a very small extent at temperatures below 50° F. (10° C.). They are harmless, and they, moreover, render good services by delaying or obstructing the growth of dangerous putrefactive bacteria which reach the milk from excreta.

(ii.) *Butyric Acid-forming Microbes.*—This group of organisms produces butyric fermentation, which is an acid change. These grow best at a temperature approaching that of the human body, 98.4° F. (37° C.), and produce spores (seeds), which resist for some time the temperature of boiling water—212° F. (100° C.). The products of their growth cause serious disturbance in the digestive tract of man, more especially of children. The spores of the bacteria of butyric fermentation are not killed by pasteurization—the heating of milk at temperatures below boiling-point.

(iii.) *The Bacilli of Alkaline Putrefaction.*—These are spore-bearing micro-organisms, which are difficult to kill by heat,

and produce putrefactive fermentations, which are alkaline changes.

These changes frequently proceed without naked-eye indications—*i.e.*, without the milk curdling.

(iv.) *Disease Bacteria*.—Apart from these three groups, which are constantly met with, the organisms of specific disease (*e.g.*, *Bacillus tuberculosis*, *Bacillus typhosus*, *Bacillus diphtheriæ*, etc.) are frequently found. As these last are non-sporing, a comparatively low degree of heat—say 149° F. (65° C.), applied for twenty minutes—is sufficient to destroy them. General pasteurization is not to be recommended, because by it harmless lactic acid bacteria, which cause the souring of milk, and which act as an indicator of its freshness, are destroyed, with the result that the dangerous spore-bearing bacteria, previously inhibited by the lactic varieties, then run riot. The length of time during which milk will keep—that is, the time which must elapse before bacteria develop in sufficient numbers to produce perceptible changes in it—is principally governed by two factors—*viz.*, temperature and the initial number of bacteria present.

Under ordinary favourable conditions, the number of bacteria in milk freshly drawn from a healthy cow varies between 500 and 20,000 per cubic centimetre (c.c.). Milk can be produced on a commercial scale containing less than 5,000 bacteria per c.c. On the other hand, carelessly produced, the number may reach 500,000,000.

(b) *Clean Milk without Preservatives or Sterilization*.—Lux has shown that with ordinary care it is quite possible to obtain a milk containing on an average 1,400 bacteria per c.c.

It is obvious that, with a little more care, this number could be largely reduced.

Were milk taken from healthy cows, under aseptic conditions, immediately cooled to 45° F. (7° C.), kept at that temperature in sealed vessels, and used within twenty-four to thirty-six hours, there would be no need of pasteurization, sterilization, or the addition of preservatives.

That milk can be produced and kept in such a cleanly manner that it will remain absolutely pure and fresh for weeks has been abundantly demonstrated. This is the ideal which must be held up before the country until the consumer and the dairyman alike are sufficiently educated to demand its fulfilment. No weak pleading concerning the increased trouble and cost of producing such an article must be allowed to obstruct the issue. Healthier cows, living on a selected dietary, must be

groomed and cleaned, so that bacteria will not fall from their udders and bodies into the milk-pail. The milker's hands must be absolutely clean (sterilized), and himself furnished with a properly constructed and sterile pail. He must be made to understand that he is expected to turn out a milk as nearly free from bacteria (sterile) as may be, and that to prevent its future contamination by the multiplication of the few bacteria that inevitably enter it, he must make the necessary free use of ice, which can be produced at a very cheap rate.

Railway authorities and their servants, milk vendors and their servants, and mothers and nurses in the home, must all possess and act upon the same knowledge. Such a reformation is outside legislation, and can only be accomplished by the consumer insisting on being supplied with milk that has been produced in a thoroughly scientific manner.

(c) *Preservatives in Milk*.—As milk enters into the diet of most people, and is the chief or only food of infants, young children, and many invalids, it is obviously most important that it should be free from any substance injurious to health. Milk presents opportunities for the introduction of preservatives all along the line, from the farm to the consumer, and public analysts have at times reported preservatives in more than 50 per cent. of the samples examined.

*Bi-carbonate of soda* is occasionally added, but the small quantities which can be employed without detection by the consumer do not destroy bacteria. By its action curdling and souring are delayed. It thus acts as a mask to old milk, and therefore its use should be debarred.

*Boric acid* and *borax* are much more frequently found than other preservatives. Quantities of boric acid running from 2 grains to 80 grains per pint have been detected. Both boric acid and borax possess little germicidal properties, and in order to produce any appreciable degree of inhibitory action upon the bacteria usually found in milk, at least 10 grains of boric acid and somewhat more borax must be added per pint.

As has been mentioned above, there is as yet no scientific evidence from which to draw definite conclusions concerning injury to health from boron compounds, as ordinarily found in food; but apart from the question of such injury to health, it must be admitted that the addition of boric acid, borax, or any other preservative, to milk puts a premium on the production and sale of filthy and stale milk, a food highly injurious to health, more especially in the case of infants, to whom it is



frequently fatal. If for no other reason than this, the use of boron compounds, as of all preservatives, should be forbidden by statute.

*Formalin (formaldehyde)* is an excellent germicide, but the curd (casein) of formalined milk is rendered somewhat insoluble, whereby the digestive processes in the stomach and intestines are handicapped.

*Peroxide of hydrogen* was used by Budde for the destruction of bacteria in milk, and this process has been adopted in some places instead of pasteurization. It is said that 15 c.c. of a 3 per cent. solution of the peroxide are sufficient for a litre of milk.

*Salicylic acid* is sometimes added to milk in addition to boric acid; but occasionally it is added alone.

2. **Cream.**—More samples of cream than milk contain preservatives. Boron compounds, formalin, and salicylic acid are found. Various quantities of boric acid have been recorded, ranging from 0·2 to 0·8 per cent., roughly 19 to 70 grains per pint. Salicylic acid is frequently found in conjunction with boron compounds.

Whilst larger amounts of preservatives are usually added to cream by reason of the much longer period of storage, very much smaller quantities of cream are consumed, and the risk of danger to health is accordingly less. But in that cream is frequently administered to infants, young children, and invalids, and in that it has been demonstrated by well-conducted dairies that it can be distributed in a perfectly sound condition without the use of preservatives, there seems to be no more good reason for allowing the addition of these bodies to cream than to milk.

3. **Butter and Margarine.**—Boric acid and borax, in conjunction with a small quantity of salt or saltpetre, form the principal preservatives met with in butter and margarine. Very occasionally formalin is used. Although fat is not nearly so good a medium for the cultivation of bacteria as milk, there is always sufficient milk retained in butter to maintain a copious growth of organisms, and English butter often presents a bacterial flora as varied as that of milk. The flavour of butter is due solely to the products of the bacterial activities found in it, and has nothing to do with the feeding of the cows.

This has been so recognized in Denmark and America that the finest flavours are produced artificially by first killing off the existing bacteria by pasteurization of the cream, and after-

wards adding a laboratory pure culture known as a "starter." It is stated that in order to get the best results the cream must be pasteurized at or about 194° F. (90° C.), a higher temperature than that which is applied to milk.

Saltpetre is occasionally employed alone, but more often in conjunction with boric acid or common salt. A quarter of an ounce to a pound of butter is frequently used. Common salt is practically never used alone as a preservative, as more than 10 per cent. would be required. If proper precautions be observed in the production of butter, more especially if the "starter" method be adopted, and if the water be eliminated, no necessity can exist for the use of preservatives.

Fluorine compounds have been met with in butter and cream. The alkaline salts of fluorine, even to the extent of 0.02 per cent., inhibit salivary and gastric digestion. The compound of sodium with fluorine (NaF) greatly lowers blood-pressure. All compounds of fluorine should be rigorously excluded from foods.

The same preservatives are found in margarine as in butter, and proportionately larger quantities when margarine is churned with milk.

There is no more reason for the use of preservatives in butter and margarine than in milk.

4. **Meat and Game.**—(a) *Fresh Meat and Game.*—Grave suspicion should attach to the flesh of animals slaughtered on account of accident or so-called trifling diseases. Certain diseases formerly considered local are now proven to be more or less general infections. Apart from the specific diseases found in cattle and sheep, the most searching scrutiny should be applied to any ill-defined affection discovered in an animal intended for slaughter, more especially if such condition be associated with diarrhoea or wasting.

As meats can be preserved by cold storage, drying, sterilization by heat, and cured with condiments, it is as reprehensible as it is unnecessary to use harmful chemicals. A distinction should be made between fresh meats passed to the consumer within a week after slaughter and cold storage meats kept for a longer period than a week. There is a limit to the length of time meat should be kept in cold storage, since it is most difficult to completely eliminate the action of organisms which produce decomposition. Except in cases of emergency, meat should not be kept in refrigerators longer than is actually required for transportation and distribution.

Meat kept in cold storage longer than eight weeks may be regarded as preserved meat.

All packages of meat exposed for sale should possess a label indicating the date of slaughter.

While meat remains fresh longer than milk, means must be taken to prevent decomposition in hot weather during the period that it is "hung."

Game and poultry are preserved in the same way as meat. Game, which is usually kept until decomposition (bacterial growth) has commenced, is doubtless frequently responsible for much gastro-intestinal disturbance.

Formalin, formaldehyde, and permanganate of potash (Condy's Fluid) are frequently brushed over fresh meats that are beginning to smell. (For food poisoning due to bacteria, see Ptomaine-Poisoning.)

(b) *Meats, Salt, Dried, Potted; Sausages.*—In the case of flesh that is to be kept for an indefinite time—such as bacon, ham, etc.—some method of preservation is essential.

Methods in vogue are smoking, drying, sterilizing, refrigerating, and the addition of chemical preservatives. Table salt (sodium chloride) alone, or in conjunction with saltpetre, is largely used. More than 10 per cent. of sodium chloride is necessary to completely check bacterial growth.

Alum, boric acid, sugar, and sulphites enter into the composition of a number of pickling solutions. Saltpetre is largely used, not for antiseptic purposes, but to prevent the decolorizing influence of salt on muscle. Hams and sides of bacon imported from America are packed in boric acid, a varying portion of which makes its way into the interior of the flesh. The quantities reported by different observers range from 0.125 to 0.750 per cent.

Formalin and permanganate of potash are frequently brushed over the surfaces of joints. Formalin is found in potted meats, meat extracts, and sausages.

Salicylic acid and boric acid are used in potted meats, meat extracts, and sausages. The last are frequently dyed.

5. **Fish.**—(a) *Fresh.*—Fish decomposes much more rapidly than meat, and some kinds of fish—*e.g.*, mackerel and shell-fish—more rapidly than others. A generous use of clean ice coupled with rapid means of distribution should be insisted on by all consumers of fish. Filthy ice, when it melts, may contaminate with the organisms of putrefaction and of specific disease the fish it is intended to save.

The preservatives found in fish are those used in meat.

(b) *Tinned Fish*.—Occasionally metallic tin, or a salt of the metal, and traces of lead from the solder, are to be found in tinned salmon, lobster, etc.

6. **Eggs**.—Eggs are preserved by dipping them in solutions of sodium silicate, salt, lime, and sulphites, and occasionally by covering them whilst warm with fat.

7. **Fruits, Fresh and Preserved**.—Fruits when damaged rapidly decompose, but sound fruit requires no preservatives if used within a reasonable time. In bottled and tinned fruits, complete sterilization by heat and exclusion of air are all that is necessary. Salicylic acid, sulphites, and occasionally formalin, are found in preserved fruits and jams. Traders find that by the addition of preservatives a larger quantity of water can be retained in these goods which are usually preserved in sugar. More water, of course, means increased weight, and consequently increased profit. The dilution of the sugar without preservatives would otherwise lead to fermentation. Salicylic acid is commonly found in the proportion of 2 to 3 grains to the pound.

8. **Vegetables**.—Vegetables are preserved with boron compounds, formalin, and sulphites. Copper sulphate is found in green peas, etc., as a colouring matter to the extent usually of 2 to 4 grains to the pound.

9. **Alcoholic Drinks**.—Where beverages contain large quantities of alcohol, such as brandies, whiskies, etc., there is no necessity for the addition of preservatives. In others of low alcoholic strength, such as cider, beer, etc., it is considered necessary to check the growth of organisms which carry on acid and other fermentations. This is met by pasteurization, filtration, or the addition of chemical preservatives. The use of preservatives is quite unnecessary. Salicylic acid, benzoic acid, and the sulphites are frequently found in beer, the first to the extent of 1 or 2 grains per pint, and the last, mostly in the form of sulphite of lime, to the extent of double or treble this quantity. The same preservatives are used in cider to prevent the complete conversion of the sugar and the formation of a cloudy growth of bacteria. In both beers and ciders, where sound raw products only are used, preservatives are not required.

The French prohibit all preservatives in their wines, with the single exception of common salt, and that to the extent of only a gramme per litre.

English wines often contain salicylic acid, formalin, and sulphites. Salicylic acid has been found in raspberry and ginger wines in the proportion of 20 grains per pint. The Departmental Committee very rightly concluded that wine which cannot be kept without the use of preservatives had better not be offered for sale.

10. **Non - Alcoholic Drinks.**—In some of the so-called non-alcoholic beverages 3 or 4 per cent. of alcohol may be found through the fermentation of part of the sugar they contain. The carbonic acid or carbon dioxide, which is used in the manufacture of soda-water, seltzer, lemonade, etc., largely prevents fermentation, so that preservatives are rarely used in these; but to the non-aerated varieties salicylic acid and sulphites are frequently added. Very occasionally boric acid and formalin have been detected. The Departmental Committee suggested that salicylic acid, when added to such beverages, should not exceed a grain per pint. This Committee might have gone farther and advised, as in the case of wines, the removal from commerce of all articles that, in order to be kept, require the addition of preservatives.

### Colouring Matters.

These are found in milk, cream, cheese, sauces, sugar, and, although often harmless, their presence is intended to deceive. At present aniline dyes are, almost without exception, alone used.

When it is remembered that none of these colouring matters is in any case necessary, and that many of them, even in small quantities, are poisonous, it will surely be admitted that the public health would benefit by their universal prohibition. Short of this, a declaration of the material used and its quantity should in all cases be required. On this subject the Departmental Committee expressed its views in the following terms:

“ While we are of opinion that articles are very much preferable in their natural colours, we are unable to deduce from the evidence received that any injurious results have been traced to their consumption. Undoubtedly some of the substances used to colour confectionery and sweetmeats are highly poisonous in themselves, but they are used in infinitesimal proportions; and before any individual has taken enough of colouring matter to injure him, his digestion would probably have been seriously disturbed by the substance which they are employed to adorn.

“The employment of copper sulphate to colour peas and other vegetables has been carefully considered by us. It is highly undesirable that what is admittedly a poisonous substance should be used, even to the smallest extent, in connection with such food as may be consumed in considerable quantity. The public have got it into their heads that vegetables ought to be green, and green they insist upon having them. Direct proof that vegetables containing copper are injurious to the consumer is, from the very nature of the case, difficult to obtain, and we must admit that we have not succeeded in obtaining it. There is evidence pointing to the conclusion that the copper, when added to the vegetables, forms a compound which is not easily soluble in the human economy. There is, however, evidence of a contrary character, and it is not clear to us that the copper added becomes or remains insoluble under all conditions. Be this as it may, recent events have so incontestably demonstrated the serious and widespread mischief which may result from the consumption of food and drink, other than sweetmeats, containing even minimal quantities of poisonous metallic substances, that we are strongly of opinion that such poisonous substances should be rigorously excluded. There is such a wide choice of colouring matter suitable for the dairy trade that no inconvenience would arise from restricting it to the use of innocuous substances, as these may be defined and permitted in the manner hereafter suggested.

“But the same reason which we have given for the prohibition of preservatives offered for sale—namely, the large quantity thereof that may be consumed by an individual—appears to render it highly undesirable that any colouring matter should be permitted in milk. There is this further consideration—that milk is sold as an absolutely raw, unmanufactured article, of which the purchaser is entitled to be aware of the natural colour, and to draw his own conclusions therefrom as to quality. In the butter trade, and still more in the cheese trade, artificial colouring has long been established. Highly coloured goods find favour in some markets, uncoloured or faintly coloured goods in others. We have not found that in the interests of the consumer any interference is necessary with the customs of the trade in this respect.

“In regard to margarine, we have to deal with a cheaper and relatively inferior article, invariably coloured to resemble a more costly and superior article, and probably the only means of protecting the public from imposition would be to prohibit

the introduction of any colouring matter into margarine which shall cause it to resemble butter. Be the regulations as to the sale of margarine under declaration what they may, they cannot protect the customer who calls for bread and butter at an hotel or restaurant from being served with bread and margarine, and paying for it at the rate charged for the superior article.

“But as the margarine may be assumed to be a perfectly wholesome article of diet, it does not fall within the terms of our reference to make any recommendation upon a practice which is not attended with risk to the public health.”

The Committee made the following recommendations:

“That the use of any preservative or colouring matter whatever in milk offered for sale in the United Kingdom be constituted an offence under the Sale of Foods and Drugs Act.

That the use of copper salts in the so-called greening of preserved foods be prohibited.

“That means be provided, either by the establishment of a separate court of reference, or by the imposition of more direct obligation on the Local Government Board, to exercise supervision over the use of preservatives and colouring matters in foods, and to prepare schedules of such as may be considered inimical to the public health.”

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*For legal cases of Preservatives and Adulterants in Food, see CASE GUIDE: Preservatives and Adulterants in Food.*

# PTOMAINE (FOOD) POISONING.

BY W. H. WILLCOX,

M.D., B.SC. (LOND.), D.P.H., F.I.C.,

Lecturer on Public Health and Forensic Medicine to St. Mary's Hospital,  
London, W.; Physician to Out-Patients, St. Mary's Hospital;  
Senior Scientific Analyst to the Home Office.

## Head-note.

THE dangers from ptomaine-poisoning are diarrhoea and vomiting, producing prostration, and even death.

## Technical Terms.

*Agglutination Test.*—The bacilli which produce a disease (*e.g.*, typhoid) are grown from a pure culture of these organisms in a nutrient liquid substance originally free from bacilli. The liquid becomes turbid from growth of the organisms, and if some of this opalescent liquid is placed on a glass slide under the microscope, the bacilli will be seen scattered.

A drop of the serum of the blood of a person suspected to be infected with the same disease (typhoid) is now allowed to run in among the bacilli under the microscope. If the person is suffering from the suspected disease, the bacilli will run together and “agglutinate.” This test is known, from its discoverer, as “Widal’s Reaction,” but although useful, admits of error.

This test is so delicate that if the blood-serum of the patient is much diluted agglutination still occurs. In typhoid fever, agglutination will occur if the patient’s blood-serum is diluted 50, or even 100, times.

*Bacteria.*—Rods or round cells of a nature that is probably more nearly allied to the vegetable than to the animal kingdom. Their size is of extreme minuteness; a red blood-corpuscle, which is  $\frac{1}{2000}$  inch in diameter, can support many of them. They multiply with great rapidity by splitting into pieces, usually halves; each half speedily enlarges to the size of a whole, and again subdivides. In some cases small seeds or spores are made, one or more in each bacterium. These spores are much more resistant to heat and antiseptics than



the bacteria themselves, and remain in a condition of vitality for a long period. Many bacteria do not form spores.

Bacteria are of different sizes and shapes. Cocci are small round cells; bacteria, strictly, are rods, but the bacteria, further, have various shapes, some being curved, some big at one end, some very long, some thick and short. (See Incubation Period.)

*Cocci*.—Spherical form of micro-organisms. (See Bacteria.) The organisms of gonorrhœa, pneumonia, etc., are cocci.

*Enteritis*.—Inflammation of the intestine.

*Gastritis*.—Inflammation of the stomach.

*Gastro-Enteritis*.—Inflammation of the stomach and bowel. A form of diarrhœa and vomiting especially common in children during summer, known as "summer diarrhœa," is due to gastro-enteritis. Gastro-enteritis also occurs in adults from various causes.

*Incubation Period*.—When disease is produced by microbes, some time must elapse before there is enough poison or microbes, or both, in the body to cause symptoms of the disease. Though there is some margin, this period is fairly fixed for each disease. The period elapsing between the introduction of the microbes and the onset of the symptoms is called the "incubation period."

*Latent Period*.—If a dose of poison (not microbes)—*e.g.*, strychnine, or ptomaines in food—be taken, then a short time will elapse between the taking of the poison and the onset of the symptoms. This is called the "latent period." The term "incubation period" should be reserved for those cases where the delay in the onset of the symptoms is due to the growth of microbes in the body.

*Lymphoid FollICLES*.—The lymph canals in the intestines are interrupted by enlarged spots of a glandular nature. These spots are normally about the size of a pin's head, and are called "lymphoid follicles." (For their functions, see Vessels—Lymphatics.)

*Peyer's Patches*.—Patches of glandular tissue connected with the lymphatic system, normally about  $\frac{1}{12}$  inch thick,  $\frac{1}{2}$  inch long, and  $\frac{1}{4}$  inch broad. They occur in the small intestine, and become much enlarged in some diseases, especially typhoid.

*Ptomaines*.—Organic chemical substances derived from ammonia (an alkali), and resembling in composition the alkaloids (such as morphia). They were originally thought to be the source of the various forms of food-poisoning known as "ptomaine-poisoning."

It is now known that very few of the ptomaines produce poisonous symptoms when swallowed, the real poisons being toxins. Ptomaines can be extracted from decomposing foods in much the same way as alkaloids. The process is, however, difficult. (See next, Toxines.)

*Toxines*.—Active poisonous products of bacteria acting on organic substances, such as albumin, meat, etc. Their chemical composition is allied to albumin, of which white of egg is a type. Chemically these toxins are known as toxalbumins or toxalbumoses (albumose

being a substance allied to albumin). The presence of the toxins alone, even without the bacteria, may produce symptoms known as "toxic intoxication."

### The Nature of Ptomaine-Poisoning.

When the term "ptomaine-poisoning" was first introduced, it was thought that chemical substances called "ptomaines" were the principal poisonous products resulting from the contamination and decomposition of food. The term was indiscriminately applied to all cases of poisoning which resulted from contamination of food by bacteria. Since that time our knowledge of bacteriology has greatly increased, and it is now known that the poisons present in contaminated food are usually not ptomaines, though in some few cases these may be present.

The actual chemical poisons are not ptomaines; they are toxins produced by the bacteria, and are usually of the nature of toxalbumins and toxalbumoses. These toxins, acting alone on the body, or in combination with bacteria that have been present in the food introduced into the system, are the cause of the symptoms of the disease known as "ptomaine-poisoning."

In many recent articles on the subject, the term "food-poisoning" has been used in place of the older term "ptomaine-poisoning," in order to describe cases of this nature.

The former term is certainly more accurate, but since the popular use of the term "ptomaine-poisoning" is still retained for the purpose of indicating special cases of food-poisoning, and since the term is still commonly used in the certification of death and in the medico-legal description of the disease, it has been thought advisable to retain it. When food becomes contaminated by bacteria, the organisms will, under suitable conditions, grow and multiply at a great rate, especially if the food forms a medium rich in nitrogenous constituents—*e.g.*, meat, fish, etc. As a result, poisonous chemical substances, "toxins" are often formed.

These toxins are often very poisonous, and will quickly produce severe symptoms if taken into the human body.

The period elapsing between the ingestion of the food and the onset of the symptoms may be called the "latent period" of this type of ptomaine-poisoning. It will be readily seen that the greater the amount of toxins present in the food, the earlier will the symptoms be in developing, and the shorter the "latent period."

Many of these toxins require considerable heat to destroy their activity, and though the cooking of food, or boiling, will certainly diminish their activity, it is not an unfailing protection from the disease.

**Bacterial Poisons.**—Some bacteria, or their spores, when present in food will give rise to ptomaine-poisoning even if toxins have not been formed in the food before it was ingested. In this case the incubation or latent period of the disease will be longer, because the toxins require time to form inside the body by the growth of these microbes before the symptoms can become marked. The duration of this latent or incubation period under these conditions may be from a few hours to three or four days.

**Toxine-Poisoning.**—Where toxins in considerable quantity are present in the food at the time of its ingestion—*i.e.*, a big dose is taken—the latent period will be short: only a few hours. In most of the cases of ptomaine-poisoning the fact of the greatest importance is the presence of living bacteria or their spores in the food ingested.

**Mixed Bacterial and Toxine Poisoning.**—It is important to remember that the contaminated food may contain both toxins in appreciable amount and also living bacteria, so that a short latent period may mean poisoning by preformed toxins, and at the same time a bacterial infection.

#### The Bacteriological Conditions under which Ptomaine-Poisoning arises.

The poisonous condition known as “ptomaine-poisoning” arises under one or more of the following three conditions:

- (i.) The ingestion of preformed toxins.
- (ii.) The ingestion of bacteria which grow and produce the toxins inside the living body.
- (iii.) The ingestion of ptomaines the product of putrefactive bacteria. These putrefactive bacteria produce ptomaines which are usually harmless, but occasionally poisonous.

The bacteria which produce the toxins, whether without the body or within the body, belong to two main groups. The first group are putrefactive bacteria. They usually have produced toxins before ingestion of the food. The second and more important group, though capable of generating poison outside the body, are also capable when taken into the body

of producing an effect (usually diarrhoea and vomiting) by setting up symptoms of some long duration allied to a definite disease. These bacteria are called "pathogenic bacteria." They are allied to the typhoid fever bacillus.

(i.) **Putrefactive Bacteria producing Toxines.**— These organisms can by their growth produce toxines, and food containing the bacteria or their toxines may give rise to symptoms of ptomaine-poisoning. For example, attacks of diarrhoea and vomiting may follow the eating of high game.

It is certain, however, that the putrefactive bacteria play a small part in the causation of ptomaine-poisoning.

The *Bacillus proteus*, one of the commonest of the putrefactive bacteria, has been alleged to be the cause of some epidemics of ptomaine-poisoning, and it is known that this organism can produce poisonous toxines.

If meat or other food were contaminated with putrefactive bacteria, it would probably have an offensive smell. It is important to remember that most of the cases of ptomaine-poisoning are due to organisms which do not produce offensive-smelling substances, so that the poisonous food may have no objectionable smell or suspicious taint, and yet give rise to severe illness.

(ii.) **Bacteria which grow and produce Toxines within the Body.**—Organisms allied to the *Bacillus* of Typhoid and to the *Bacillus* usually present in the Large Intestine (Colon): *Bacillus Coli Communis*.—The following are the principal ones:

- (a) *Bacillus enteritidis* (Gärtner).
- (b) *Paratyphoid bacillus*.
- (c) *Bacillus botulinus*.
- (d) *Bacillus coli communis*.
- (e) *Bacillus enteritidis sporogenes*.
- (f) *Bacillus dysenteria*.

(a) The most important and most common cause of the disease is the *Bacillus enteritidis*, first described by Gärtner, which has been responsible for many severe outbreaks of illness. There appear to be several organisms belonging to the *Bacillus enteritidis* group, which resemble one another generally, but differ in some important detail from the bacillus described by Gärtner. These have in many cases been named after the outbreak to which they have given rise; e.g., the *Bacillus Derbiensis* was an organism of this group which caused the outbreak of pork-pie-poisoning at Derby.

The toxins produced by the *Bacillus enteritidis* organisms are remarkably resistant to heat, and are not destroyed at the temperature of boiling water.

(b) The *paratyphoid bacillus* has been the cause of some outbreaks.

(c) *Bacillus Botulinus*.—This organism has been the cause of many outbreaks of sausage-poisoning.

(d) *Bacillus Coli Communis*.—This organism is always present in the large intestine; it has been found on a few occasions in the infected meat which has given rise to illness. The particular organism which caused the illness must have been one of special virulence, as this bacillus does not as a rule cause ptomaine-poisoning.

(e) *Bacillus Enteritidis Sporogenes*.—This is an organism which was first isolated by Klein from milk. It has been responsible for some outbreaks of gastro-enteritis, especially in children, where the symptoms were similar to those of ptomaine-poisoning, and the disease would be expressed by this term.

(f) *Bacillus Dysentericæ (Shiga)*.—This organism is the cause of infective dysentery, and organisms similar to it have been found to be the cause of some cases of milk-poisoning.

Organisms other than these here described have, in some cases, been found in food, and have been stated to have caused illness.

### Disease.

1. **Caused by Ptomaine-Poisoning.**—*Incubation Period.*—As has been mentioned, the period which elapses between the ingestion of the infected food and the appearance of the first symptoms is known as the latent or incubation period of the disease. It has been observed to vary between a few hours and three or four days. The greater the amount of preformed toxins in the food, the shorter will be the latent period. The latent period is influenced by other conditions. Thus, if the poisonous food is taken on an empty stomach, the symptoms will come earlier. Again, if the infected food is taken alone, the symptoms will occur earlier than if it is taken with a considerable amount of other wholesome food.

In the Welbeck epidemic, investigated by Dr. Ballard, the latent period was accurately determined in 51 cases. In 5 it was 12 hours or less; in 34 it was 12 to 36 hours; in 8 cases it was 36 to 48 hours.

*Symptoms.*—The symptoms are of sudden onset. They are usually those of gastro-enteritis—viz., furred tongue, severe abdominal pain with a rise of temperature. Vomiting and purging are often present, associated in severe cases with considerable collapse and heart weakness. The stools are liquid and very offensive, and sometimes contain mucus and blood. In some cases a rigor (shivering fit) may usher in the attack.

In severe cases cramps in the calves of the legs are present, and the patient may become cold and blue owing to the feeble circulation consequent on a state of extreme collapse.

In some cases rashes appear—*e.g.*, “erythema,” a diffuse redness of the skin; or “urticaria,” a swelling of the skin, often associated with redness; and in severe cases “purpura,” or hæmorrhages in spots under the skin.

Often the severe cases present the symptoms of bacterial infection of the blood (septicæmia), and such complications as pneumonia are then likely to occur.

In some attacks of ptomaine-poisoning, especially those due to contaminated fish, the toxins appear to especially act on the bloodvessels, producing rashes with considerable swelling of the skin (erythema and urticaria), which are associated with fever and a furred tongue, though there may be but little or no diarrhœa and vomiting.

In some outbreaks of ptomaine-poisoning, only a few persons who partook of the food responsible for the illness have been affected. This may be due to the contamination of the food in parts, the poison not being diffused uniformly through it. Another reason may be a special susceptibility of the persons affected, owing to causes mentioned below.

The special symptoms due to *Bacillus botulinus* (botulismus), which are commonly due to sausage-poisoning, are described above, p. 665.

2. **Conditions existing before the Poisoning and aggravating its Effects.**—It is important to remember that the symptoms of ptomaine-poisoning are much more likely to affect individuals who are suffering from starvation, and who take the infected article into an empty stomach. Several cases have come under the writer’s notice where the severe symptoms were undoubtedly induced by the previous condition of malnutrition from semi-starvation, which weakened the alimentary tract and rendered it especially liable to infection. A person suffering from some chronic disease of the alimentary tract, such as dysentery, chronic inflammation of the large intestine (colitis), or chronic

inflammation of the stomach (gastritis), would be predisposed to the effects of any irritant food. Thus, in a person suffering from any of the above conditions, contaminated food which would give rise to only slight symptoms in a healthy person would cause very severe and dangerous symptoms.

### Types of Food which have given rise to Ptomaine-Poisoning.

(a) **Meat.**—This has been responsible for a large number of cases of ptomaine-poisoning. Several well-known epidemics have been investigated.

The infection of the meat may arise in two ways :

1. The animal is healthy when slaughtered. Its flesh is wholesome, and free from bacteria. Owing to lack of care in the storage or in the cutting up of the flesh, it becomes contaminated by bacteria from without, and these organisms may grow rapidly through the meat and render it poisonous.

2. The animal may be diseased at the time of slaughtering; and the bacteria of the disease may be widely distributed in the tissues and organs. If such meat be eaten raw or imperfectly cooked, it will very likely cause disease, and even if thoroughly cooked illness may arise, since the toxins of some of the pathogenic bacteria are remarkably resistant to heat.

*The Welbeck Outbreak in 1880 (Ham).*—A large number of persons were poisoned by eating infected ham at a public luncheon; the symptoms were typically those of an inflammation of stomach and bowels (acute gastro-enteritis). There were seventy-two cases, four being fatal. The ham had been exposed to sewer air, and was thought to have been infected in this way. Klein isolated an organism of the *Bacillus enteritidis* group, and proved that this was the cause of the outbreak.

*Pork.*—In 1881 a similar outbreak occurred at Nottingham from the eating of hot baked pork. Klein found an organism resembling the bacilli responsible for the Welbeck outbreak.

In 1888, at Frankenhausen, a severe epidemic occurred. The persons affected ate the meat of a cow which had been slaughtered on account of a severe inflammation of the intestines. There were fifty-seven cases, one being fatal. The *Bacillus enteritidis* (Gärtner) was found in the meat and organs of the cow, and was present in the discharges of the affected persons. The symptoms were typically those of ptomaine-poisoning.

*The Derby Outbreak in 1902.*—This was due to the eating of pork-pies which were to external appearances and taste perfectly good and wholesome. About 210 cases occurred, four being fatal.

Delépine isolated an organism of the *Enteritidis* group from the intestines of two of the fatal cases, and this organism gave the agglutination test with the blood-serum of other persons affected, thus proving that it was the cause of the disease. The evidence showed that the hogs were healthy before slaughtering, and that the contamination of the food was due to the organisms from the intestinal contents of the animals coming in contact with the chopped meat.

(b) **Sausages.**—Many epidemics of poisoning have occurred from infected sausages. This can be readily understood, since the process of mincing which the meat undergoes renders it liable to contamination. Moreover, in sausages it is easy for unwholesome meat to be used with little possibility of detection.

The fact that sausages are made with raw or only partly cooked meat, and that they are frequently eaten merely smoked, with little or no cooking, still further adds to the risk.

The types of illness are similar to those described above, but one special organism, the *Bacillus botulinus*, has frequently been found associated with sausage-poisoning.

*Symptoms of Sausage-Poisoning (Botulismus).*—The toxins of this organism have a very characteristic action on the nervous system. Paralysis of the muscles of the eye, inability to swallow, and general loss of power in other muscles of the body, are special features. In addition there is inflammation of the mouth and throat. Marked collapse and delirium, with no rise of temperature, occur in severe cases. Vomiting, diarrhoea, and abdominal pain are frequently absent, the symptoms being almost entirely of the paralytic type.

(c) **Tinned Meat.**—This has been frequently the cause of ptomaine-poisoning. The meat may be contaminated by poisonous bacteria before tinning, and though the process of canning, by the heat applied, may kill the microbes, yet the toxins may not be destroyed, and these will give rise to symptoms of poisoning when the food is eaten.

(d) **Fish.**—Numerous epidemics of ptomaine-poisoning have been due to the eating of fish. These have been due to the contamination of the fish with bacteria of the type already described, and the resulting symptoms have been



similar in character. The cooking of the fish—boiling, frying, etc.—may not entirely destroy the toxins present.

(e) **Shellfish.**—These are frequently grown in waters contaminated by sewage, and microbes of disease get ready access to the fish. Mussels, oysters, lobsters, crabs, etc., have frequently caused severe attacks of ptomaine-poisoning, and commonly the fish appeared perfectly fresh, with no objectionable taste or smell. In 1903 a large number of the guests who attended the mayoralty banquets at Southampton and Winchester were afterwards affected with symptoms of ptomaine-poisoning, and some developed typhoid fever. Practically all affected by the illness partook of oysters. An investigation by Klein showed that the oysters contained organisms of the *Bacillus enteritidis* group, and it was found that they had been gathered from beds which were polluted by sewage.

(f) **Tinned Fish.**—This, like tinned meat, may give rise to poisoning from the contamination of the food by bacteria before canning. It is important to remember that tinned fish, even if wholesome at the time the tins are opened, is very liable to bacterial contamination. It should never be kept, but should be eaten on the day of opening.

(g) **Vegetables.**—These may, if contaminated by bacteria of the type described, give rise to the disease.

Since, however, the bacteria find vegetables an unsuitable medium for growth, outbreaks of ptomaine-poisoning from vegetables are uncommon.

Several cases of outbreaks have been recorded, two of which deserve mention. Thus, at Darmstadt a severe outbreak occurred from the eating of tinned beans, eleven deaths resulting out of twenty-one persons who partook of the food. The *Bacillus botulinus* was found present, and the symptoms were characteristic of this organism. (See above, Sausage-Poisoning.)

At the Ohio Hospital for epileptics, 218 persons became seriously ill, and the food responsible was found to be a batch of oatmeal, which, owing to faulty storage, had been contaminated with the *Bacillus coli* and *Bacillus proteus* organisms.

It must be remembered, as has been mentioned above, that poisoning may occur from the eating of vegetables containing plants which are themselves poisonous—*e.g.*, ergot, vetch, or poisonous mushrooms. These cases are not classed as ptomaine-poisoning.

(h) **Fruit.**—This, if contaminated with microbes, may give rise to ptomaine-poisoning.

This would be more likely to occur if the fruit were bruised or broken and the juices on the surface served as a medium for bacterial growth. For the same reason as with vegetables, ptomaine-poisoning from fruit is less common than from meat or fish.

(i) **Milk.**—Milk has on several occasions been the cause of outbreaks of ptomaine-poisoning, and the organisms above quoted have been found present in the affected milk. In an outbreak investigated by the writer, several cases of illness occurred in a family as the result of contaminated milk. The milk was not sour, and had no offensive taste or smell. Those who partook of the boiled milk suffered less severely than those who took it unboiled. Poisonous toxins were obtained from the milk, and organisms of the type described above were found.

If milk is infected with the microbes, all that is necessary is a suitable temperature for their growth, and it speedily becomes a dangerous article of food. It is readily understood, therefore, that these cases are of much commoner occurrence in the warm weather of summer.

The acute diarrhœa of infants is no doubt often due to the infection of milk with organisms of the *Bacillus enteritidis* group—e.g., the *Bacillus enteritidis* or the *Bacillus enteritidis sporogenes*.

Many of these cases are, strictly speaking, cases of food-poisoning, and are of the type expressed by the term “ptomaine-poisoning” as it is commonly used.

The ordinary organisms which are responsible for the souring of milk do not give rise to ptomaine-poisoning. (See Preservatives in Food—Milk.)

(j) **Cheese.**—Cheese has often given rise to ptomaine-poisoning. Owing to bacterial infection, poisonous toxins are produced which give rise to the symptoms of the disease. A poisonous ptomaine, tyrotoxin, has been isolated, which has no doubt been produced by bacterial growth in the infected cheese.

(k) **Water.**—If polluted by sewage, water may contain the organisms associated with ptomaine-poisoning, and give rise to the symptoms of the disease. One such fatal case was investigated by the writer; the patient died from typical symptoms of ptomaine-poisoning, which investigation showed was the result of drinking water from a very polluted source.

**Other articles of food**, if contaminated with the dangerous microbes, may give rise to ptomaine-poisoning.

### Preventive Measures.

In the case of meat, care should be taken that the flesh is that of a healthy animal, and any sufficient signs of disease render the carcasses unfit for food.

This can only be insured by proper inspection by skilled inspectors, and it is a strong argument in favour of the institution in large towns of public abattoirs in the place of private slaughter-houses. Afterwards, both in the slaughter-houses and in the places of sale, every precaution should be taken to prevent the contamination of the meat by offal, dust, dirt, flies, etc. The cutting up of meat naturally exposes a greater surface for contamination, and increases the risk of infection. If a carcass is cut up in a slaughter-house, it is easy for the surface of the meat to be contaminated with some of the intestinal contents, and thus a sufficient infection with the pathogenic microbes of ptomaine-poisoning may result. (See above, Derby Outbreak.)

The use of imported meat bought cut up in small pieces, and used for the making of pies, sausages, etc., involves a considerable danger of ptomaine-poisoning, from the risk of the contamination of the food.

Insufficient cooking renders the danger from ptomaine-poisoning much greater.

Generally speaking, ptomaine-poisoning can only be prevented by insuring that the article of food is wholesome at the time of its production, and that the conditions of storage are such as to prevent contamination.

Thus, efficient inspection of slaughter-houses, meat and fish markets, dairies, cowsheds, milk-shops, restaurants, shops, and places where food is stored and prepared for consumption, would be a great safeguard.

In a few districts ptomaine-poisoning has been added under the Notification of Infectious Disease Act to the list of voluntarily notifiable diseases—*e.g.*, in the Willesden Urban District. In this way early recognition of the cases can be obtained and an early detection of the infected article of food is rendered possible, so that a severe outbreak is likely to be avoided. It would be an advantage if notification of the disease were more general.

### Operation.

There is no operation necessary in connection with ptomaine-poisoning.

### Cure.

In mild cases of ptomaine-poisoning the symptoms will only last a few days, and the patient will be well in a week, though possibly it may take a little longer for him to regain his usual strength. In severe cases of ptomaine-poisoning the symptoms may be acute and last for several weeks. In these cases the illness has usually been due to an infection of the food with pathogenic bacteria producing a disease somewhat resembling typhoid fever.

### Return to Work.

The period elapsing before the patient is able to return to his usual work will depend entirely on the severity of the attack, and is indicated in the preceding paragraph.

### Recurrence.

A patient who has had an attack of ptomaine-poisoning from contaminated food would be liable to have a fresh attack if he partook again of unwholesome food.

### Diagnosis.

It must be borne in mind that there are many diseases and conditions which from their symptoms resemble ptomaine-poisoning, and these must be carefully excluded before a diagnosis is made.

Gastritis, acute colitis, gastro-enteritis, cholera, etc., may occur from other causes than ptomaine-poisoning.

Persons suffering from malnutrition due to starvation or disease of the alimentary tract might be affected with abdominal pain, vomiting, diarrhœa, and many of the symptoms of ptomaine-poisoning. These symptoms might be due to the food taken being unsuitable to their condition, quite apart from any infection of such food by the bacteria or toxins associated with ptomaine-poisoning.

**Ptomaine-Poisoning.**—Food may be the source of various diseases or conditions of ill-health.

(a) *The action of bacteria upon the food* may produce poisons (toxines) in the food, or the bacteria themselves may act as generators of poisons after they have been swallowed. Each of these conditions is included in the term "ptomaine-poisoning," and has been described above.

(b) *Disease.*—Bacteria may produce specific diseases of well-known nature, such as typhoid, tubercle, anthrax, glanders,

cholera, Malta fever, diphtheria, etc. In these, although the effect is produced by the poison manufactured by the bacilli, the result is not known as "ptomaine-poisoning," though the products of the bacilli are poisonous and are toxines. Each disease is called by a separate name.

(c) *Parasites*.—Parasites of a larger size than bacteria produce definite symptoms.

The disease resulting from the contamination of food by certain parasites or their eggs or embryos are to be carefully distinguished from ptomaine-poisoning. Examples of parasitic diseases which arise from the ingestion of uncooked food are trichinosis, from the presence of the embryos of the *Trichina spiralis*; the diseases resulting from the contamination of food by the living embryos of the various tape-worms; and the disease (hydatid disease) resulting from the contamination of food by the ova of the small tape-worm of the dog, *Tænia echinococcus*.

(d) *Vegetable-Poisoning*.—Poisoning occurs from vegetable food when the vegetables are either poisonous or contain plants which are themselves poisonous—*e.g.*, ergot, vetch, poisonous mushrooms.

(e) *In Organic Poisons due to Accidental Metallic Infection*.—Poisoning the result of the contamination of food by metallic poisons, such as lead, zinc, tin, copper, arsenic, etc., after the eating of tinned and other foods, has to be clearly distinguished from ptomaine-poisoning, which may also arise from tinned foods.

(f) *Food Preservatives*.—The presence of deleterious chemical substances in food intentionally introduced to retard decomposition is a subject for separate treatment. (See "Preservatives in Food," p. 643.)

(g) *Drugs administered as Medicine or accidentally taken*.—Large doses of aperient drugs may produce symptoms of a kind that closely resemble ptomaine-poisoning.

It is thus seen that the term "ptomaine-poisoning" is restricted to designate the disease resulting from the infection and contamination of food by bacteria which are not of a type corresponding to those of the well-known specific diseases.

(h) It is well known that *unripe fruit* is frequently the cause of inflammation of the stomach and bowels (gastro-enteritis, summer diarrhoea) in children. This is probably due to the mechanical action of the undigested parts of the fruit giving rise to local irritation of the bowel, and thus causing an infec-

tion by the microbes normally present in the bowel (auto-infection). These cases must be distinguished from ptomaine-poisoning.

A bacteriological examination of the food which has caused the symptoms may detect one of the organisms responsible for its cause. Physiological experiments on animals would demonstrate the presence of toxins.

The blood-serum of a patient affected with the disease would give the agglutination test with a pure culture of the microbe of the disease (Widal's test). (See Technical Terms.) These methods of investigation would place the diagnosis beyond a doubt.

Chemical investigations for ptomaines or toxins are usually unsatisfactory, and even in undoubted cases are frequently negative.

Bacteriological investigations should always be given precedence in these cases.

**Post-Mortem Appearances.**—These are those of a severe gastro-enteritis resulting from bacterial infection or intoxication.

*Œsophagus (the Gullet).*—The œsophagus shows no definite changes usually.

*Stomach.*—The mucous membrane of the stomach is red and congested, but it is not ulcerated or corroded. There may be hæmorrhages beneath the mucous lining, but the stomach contents are usually free from blood; mucus is generally present.

*The Small Intestine.*—This shows signs of acute inflammation, which are usually more marked than those in the stomach. The lining (mucous membrane) is swollen and congested, and the places known as "lymphoid follicles" and "Peyer's patches" may show swelling and congestion.

*The Large Intestine.*—This often shows signs of acute inflammation, with swelling and congestion of the mucous membrane and lymphoid follicles.

The intestines contain much mucus; there is usually no ulceration of the surface, but there may be small hæmorrhages beneath the mucous membrane.

*Other Organs:*—The other organs, such as the liver, kidneys, and heart, show signs of cloudy swelling and fatty degeneration, the result of the action of the bacterial toxins.

The above post-mortem signs have to be carefully distinguished from those of an irritant or corrosive poison, for which they are sometimes mistaken.

*Corrosive Poisons.*—If an irritant or corrosive poison, as hydrochloric acid, oxalic acid, carbolic acid, arsenic, etc., be the cause of death, there are often signs of ulceration and corrosion in the mouth and gullet. The stomach shows very intense inflammation, and commonly ulceration and corrosion of its mucous membrane, with free blood in its contents. The intestines also show signs of inflammation, and there may be ulceration or corrosion of the mucous membrane in the upper part; but the signs of inflammation are most marked in the stomach, and diminish as the poison passes down the intestines, owing to its dilution by the intestinal contents.

In ptomaine-poisoning the signs of inflammation are commonly more marked in the intestines than in the stomach, and are usually as intense in the lower part of the intestine as in the upper part, and sometimes more intense.

The detection of the irritant or corrosive poison by chemical analysis absolutely distinguishes between the two conditions.

**Summary of Important Points.**—1. The term "ptomaine-poisoning" means the disease resulting from food which has been contaminated by special bacteria or their toxins. Thus, typhoid fever and other of the well-known specific fevers arising from infected food are not ptomaine-poisoning.

2. The incubation or latent period of ptomaine-poisoning is from a few hours to three or four days, usually not exceeding forty-eight hours. It is influenced by special conditions.

3. If several persons partake of the food, it is to be expected that a fair proportion will suffer from the symptoms of the disease; but either from localized contamination of the food, or from special susceptibility of individuals—*e.g.*, semi-starvation or previous disease of the intestinal tract—it is possible that only one or two persons who partook of the food may be affected. In these cases strong proof is necessary to establish responsibility of the food for the disease.

4. Ptomaine-poisoning is not usually due to the putrefactive organisms which make food offensive to the smell and taste, so that it is unnecessary to prove that the food had an objectionable smell or taste. Food may give rise to ptomaine-poisoning, and yet appear perfectly wholesome to the palate.

The converse does not hold; thus, in many cases the food had an offensive or suspicious taste or smell, indicating that putrefaction was just commencing. The bacteria which cause ptomaine-poisoning may be present together with the putrefactive bacteria.

5. Persons suffering from semi-starvation or diseases of the stomach or intestines are very susceptible to ptomaine-poisoning, and will suffer from symptoms from which others escape.

6. Many other conditions give symptoms similar to ptomaine-poisoning—*e.g.*, irritant chemical poisons, such as oxalic acid, arsenic, antimony, and other metallic poisons—also such diseases as cholera, inflammation of the large intestine (colitis), gastritis, gastro-enteritis, etc. These must all be carefully excluded.

7. When an article of food is suspected of being the cause of ptomaine-poisoning, chemical analysis is usually insufficient to furnish proof of this. Bacteriological and physiological investigations are much more likely to provide definite indications as to the probability of the article of food being the cause of the illness.

8. Cooking of food probably destroys the living bacteria present, but though this may impair the poisonous nature of the toxins present, it cannot be relied upon to entirely destroy the toxins.

9. The contamination of the food may have been due to either (1) unwholesomeness at the time of its production—*e.g.*, animal disease; or (2) contamination of the food from imperfect storage or too long keeping.

### Malingering.

It would be impossible for the symptoms of a typical case of ptomaine-poisoning to be simulated by a healthy person. Thus, the rise of temperature, the increased pulse-rate, the diarrhoea with characteristic appearance of the stools, the collapse, etc., are symptoms which could not be assumed by a malingerer. It is, of course, to be understood that these symptoms must be duly attested to by a competent observer (a person with a medical qualification).

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*For legal cases of Ptomaine-Poisoning, see CASE GUIDE :  
Ptomaine-Poisoning.*

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### PYÆMIA.

*See* INFECTION.



# RABIES, OR HYDROPHOBIA.

By EDRED M. CORNER,

M.C., F.R.C.S.,

Surgeon to the Children's Hospital, Great Ormond Street; Surgeon to the Surgical Infectious Wards and to Out-Patients, St. Thomas's Hospital;

AND

FREDERICK HOBBDAY,

F.R.C.V.S., F.R.S.E.,

Late Professor in the Royal Veterinary College, and late Examiner to the Royal College of Veterinary Surgeons.

## Head-note.

HYDROPHOBIA, or rabies, is a disease which is fatal unless the Pasteur method of treatment succeeds.

## Technical Terms.

*Central Nervous System.*—The brain and spinal cord.

*Incubation Period.*—The time which elapses between the infection and the first symptom or sign of the disease it produces.

*Sălıva.*—The secretions of the mouth.

## Nature of Rabies.

Hydrophobia, or rabies, occurs epidemically among the Carnivora, chiefly dogs and the related species of animals—wolf, fox, and jackal—and also among cats. It has been seen in horses, cattle, sheep, and pigs, after they had been bitten by a rabid animal.

The disease is common in Russia and Eastern Europe, where epidemics occur among the wolves. At the present day it is extinct in Great Britain, and in those parts of Germany where every dog is kept muzzled the disease is almost unknown. There can be no doubt that hydrophobia is due to a micro-organism, though the actual virus has not yet been found. The poison is

chiefly found in the central nervous system, the saliva, and in some of the other secretions of the body.

Though all attempts to discover and isolate the actual virus of rabies have so far failed, yet everything points to an organism being its cause. It would be difficult to believe otherwise, after seeing the successful results of protective inoculation carried out by Pasteur. The virus, it seems, is present in the saliva of affected animals, being thus easily transmitted to the victim who is bitten.

In man the incubation period varies from days to months, or even a year; but as a rule the onset takes place about six weeks after infection.

The infection is carried by the bite of an affected animal, and is communicable to other animals and to man.

### Consequences of Infection.

After a period of freedom from symptoms, called the "incubation period," during which the initial wound may heal, the affected person begins to be restless, and the other symptoms follow rapidly. In animals a furious stage sometimes precedes a paralytic stage. The furious stage rarely lasts more than three days, being rapidly followed by the paralytic stage, which may last several days. Finally the dog shows marked symptoms of exhaustion, with difficulty of breathing, intense weakness, occasionally partial or general convulsions, ending fatally about the sixth or eighth day. Recovery of an animal is unknown. (For Rabies in Animals, see below.)

### Disease.

1. **Caused by the Infection.**—Rabies is in itself a disease usually so rapidly fatal in man that it cannot be said to produce other conditions except the after-effects of the Pasteur treatment, which we need not discuss here.

2. **Existing before the Infection and aggravating its Effects.**—Diseases existing before the infection are not known to have any special effect on the course of rabies.

### Operation.

The injections given in the Pasteur treatment alone can give any hope of cure. The process is too long to be described here in detail, but the treatment consists in gradually accustoming the body to stand increasing doses of the poisons produced in

rabies, until the body has become quite resistant to very large doses. The principle of treatment consists in the development of the power of resistance during the incubation period, so that a person who is "Pasteurized" becomes protected against the poison which is transmitted in the bite before this infection from the bite has had time to grow. When it does develop, the protection is already fully established. (See Infection—Immunity, p. 439.)

### Cure.

The duration of hydrophobia, untreated by the Pasteur process, in man, is a few days, and it ends fatally. A few doubtful cases of recovery without inoculation have been reported from time to time, but the probability is these were cases of the so-called "pseudo-hydrophobia." It is hard to be quite certain that the person who is treated by the Pasteur injections is cured until some lengthy period has elapsed. The tendency of rabies to lie latent and not to develop for a long period makes the time for cure difficult to compute, but it is reasonable to assume that a bitten person is safe six months after he has left the Pasteur Institute.

### Return to Work.

No time can be fixed exactly for the capacity of a man who has been bitten by a rabid animal to return to his work. For although surgical cure may be complete, yet the mental disturbance caused by the risk incurred may delay him from resuming his occupation.

### Recurrence.

There is no risk of recurrence when once a person is cured of an attack of rabies; but, as the disease is often long delayed in being cured, it may seem that there is a recurrence, whereas in fact the first attack was really pseudo-hydrophobia, and the second, and fatal attack, one which was delayed in appearing.

### Occupation Diseases.

The most common form of occupation in which a man is likely to get rabies is one which brings him in contact with dogs.

### Diagnosis.

Rabies must be distinguished from pseudo-hydrophobia, but on ordinary occasions a fatal termination prevents any error occurring.

### Rabies in Animals.

None of the domesticated animals are immune to rabies, and it only requires direct infection from the saliva of an affected animal to cause the disease.

It has been many times observed in horses, cattle, sheep and goats, dogs, cats, or even in birds. It is, however, to the dog or cat that most attention has always been drawn, as in European countries the original centre of infection in any case of rabies is almost always traceable to one or other of this species of animal.

In England at the present time, thanks to the energetic measures adopted by Mr. Walter Long, and to the present quarantine regulations (which can be so successfully enforced owing to our insular position), rabies is a disease which is not at present existent in England, and no authenticated case has been seen either in man or beast for many years.

When once an animal becomes infected, the termination is always fatal, and the symptoms shown vary very much in the different species.

An affected horse will become frenzied, biting at the sides of the loose-box or anything it can get hold of, being very dangerous to approach. The generative organs are violently excited; there are sometimes signs of great internal pain, difficulty in swallowing, and the end is preceded by a spinal paralysis. Cattle, owing to the predisposition of the canine race to attack these animals, are very often affected in countries where rabies is prevalent, and show symptoms of frenzy, salivating freely and using their hoofs or limbs with great violence. The period of inoculation averages about one or two months, and the end, as in horses, is preceded by paralysis of the hind-quarters.

In sheep sexual excitement is a very marked symptom, and the affected animal will behave in a very violent and eccentric fashion.

A rabid cat is to be feared equally with a rabid dog, and when in this state they do not appear to know what fear means, and will attack anybody or anything. The vocal sounds become very hoarse, and the animal may wander a long way from home before death takes place. As a rule, a rabid cat will not survive the third or fourth day after the symptoms become manifested.

In the dog it is generally admitted that rabies may assume one of two forms—the “furious” and the “dumb.”

The furious is much more to be feared, as in this the animal attacks and attempts to bite anything in its course. In the first stage the dog's disposition appears to change, and it will become morbid or melancholy; this may last even for forty-eight hours, and there may be a strange inclination to gnaw and swallow foreign bodies, such as grass, wood, or stones. This stage gives way to a disposition to wander, or attack anything in its course, and a dog in this stage of the disease is an especial source of danger, as it will go for miles and bite anything which runs across its path. The bark is altered in sound to a peculiarly hoarse note, which eventually becomes an ear-piercing howl; the howl of a rabid dog, once heard, will never be forgotten. In the last stage paralysis sets in, and the patient dies.

In the paralytic variety, or "dumb rabies," the chief characteristic is a paralysis of the lower jaw, the dog having a peculiar look in the eyes, and sometimes being exceptionally affectionate. The old idea that a rabid dog has a dread of water is erroneous, for they have been frequently known to approach this fluid, although not always able to swallow properly.

The period of incubation varies from a few weeks to a few months, and one of the authors has known one certain case in which it was absolutely beyond question fully seven months. Such cases are, however, rare, and a period of six months' quarantine is all that is necessary for most practical purposes.

As regards treatment in animals, the only humane one is the speediest and most painless death possible. The necessary protection for mankind is attained by a careful search for all likely sources of infection, and the rigorous isolation, careful scientific examination, and eventual death of all animals which have been bitten. In every case an autopsy should be held upon the body of the dead animal.

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*For legal cases of Rabies, see CASE GUIDE : Rabies.*

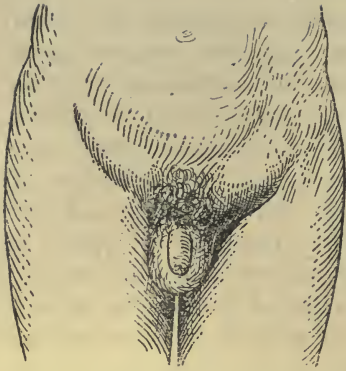


FIG. 155.—RUPTURE ON BOTH SIDES OF THE BODY : DOUBLE OBLIQUE INGUINAL HERNIA.

The swellings are above the fold of the groin and extend beyond the middle of the fold. The left is more marked than the right.

(From Rose and Carless's "Surgery.")

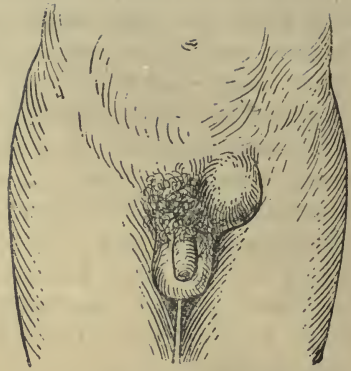


FIG. 156.—RUPTURE ON ONE SIDE OF THE BODY : SINGLE DIRECT INGUINAL HERNIA.

The lump is inclined to be round, and to be nearer the middle line of the body than Fig. 155.

(From Rose and Carless's "Surgery.")



FIG. 157.—RUPTURE ON ONE SIDE OF THE BODY : SINGLE FEMORAL HERNIA.

The lump is below the fold of the groin. This hernia is usually found in women.

(From Rose and Carless's "Surgery.")

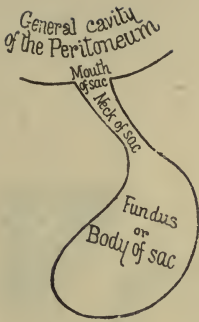


FIG. 158.—DIAGRAM OF THE "SAC," OR BAG, WHICH CONTAINS A RUPTURE.

The lining of the abdomen (the peritoneum) is continuous with that lining the sac.

(From Eccles's "Hernia.")



FIG. 159.—DIAGRAM OF A RUPTURE CONTAINING "OMENTUM" WHICH HAS REACHED THE BOTTOM OF THE "SAC," TO WHICH IT IS ADHERENT, INDICATING SOME LONG DURATION.

The omentum is represented as cut off above, and as irregular in outline, which is its normal state.

(From Eccles's "Hernia.")

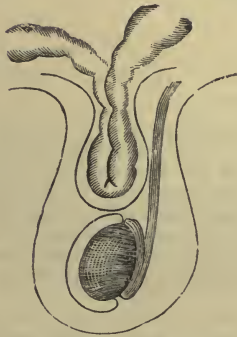


FIG. 160.—RUPTURE: DIAGRAM OF ACQUIRED INGUINAL HERNIA, WHICH LIES IN A POUCH OF PERITONEUM JUST ABOVE THE TOP OF THE TESTICLE IN THE SCROTUM, OR "PURSE," OF THE MALE.

Here are two sacs: one, peritoneal, with the hernia in it; the other, the covering of the testicle (the tunica vaginalis). These two are separate (see Fig. 161, where they are identical).

(From Rose and Carless's "Surgery.")

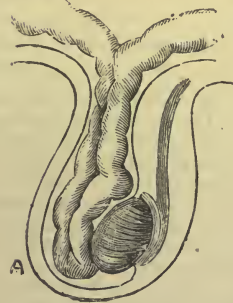


FIG. 161.—RUPTURE: COMPLETE CONGENITAL INGUINAL HERNIA.

The hernia of bowel here has come down into a congenital sac. In consequence it lies directly on the testicle inside the covering (tunica vaginalis), which is continuous with the peritoneum which lines the abdomen (from which it is usually separated off before birth).

(From Rose and Carless's "Surgery.")



FIG. 162.—THE LOWER PART OF THE ABDOMEN OF THE MALE, SHOWING THE SITES OF HERNIAS.

- On the right side the skin only is removed, showing the external abdominal ring with the spermatic cord passing through it. This cord starts from the testicle below (not shown), passes up through the external ring along the "inguinal canal" (which is laid bare on the left side) to the internal abdominal ring. The left side is further dissected, some of the muscles being cut, and the spermatic cord, as it lies in the canal, is shown.
- An indirect inguinal hernia passes downwards along the course of the spermatic cord through the internal ring, inguinal canal, and out at the external ring, taking an oblique course.
- A direct inguinal hernia does not escape by the internal ring, but pushes straight through everything which forms the floor of the external abdominal ring, so takes a "direct" course. A femoral hernia takes neither of these courses, but passes deeper by the vessels of the thigh (not shown here), and reaches the surface near the point marked *g*. The letters *a* to *g* indicate named parts.

(From Buchanan's "Anatomy.")



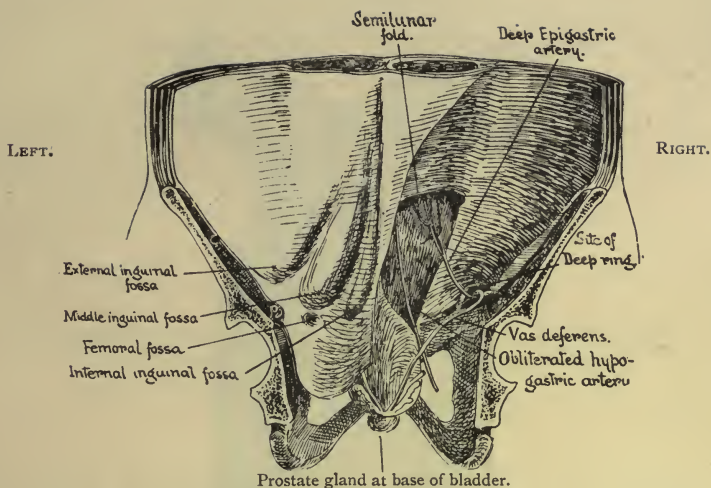


FIG. 163.—THE LOWER PART OF THE FRONT WALL OF THE ABDOMEN SEEN FROM BEHIND.

The bones of the pelvis are cut vertically, and the bladder is seen between them with the prostate gland at its lowest part. Down the back of the bladder to the prostate passes the duct of the testicle (the vas deferens), which reaches the interior of the abdomen by passing through the "internal ring."

The lining of the abdomen (peritoneum), is removed from the right half, so that the depressions which are seen on the left half do not show so clearly.

The right vas deferens, which lies behind the peritoneum, is seen only on the right side up to the internal ring, which is represented by the external inguinal fossa on the left side. It is through this "fossa" that the indirect form of hernia (inguinal) travels, following the line of the vas deferens towards, and sometimes down to, the testicle of the same side, coming out on to the surface at the external ring. The femoral fossa is a depression to the inner side of the big vessels of the leg, the femoral artery and veins, not shown here. Through this escapes femoral rupture. The vas deferens, with arteries, veins, etc., forms the spermatic cord seen in Fig. 162.

(From Eccles's "Hernia.")



FIG. 164.—RUPTURE: INGUINAL HERNIA STRANGULATED.

A loop of bowel had passed through the narrowed "neck" into the sac. The bowel became distended and could not be returned to the body. In time, through the swelling, the blood-supply was cut off, and the piece of bowel becoming mortified, or gangrenous, the sufferer died.

(From Rose and Carless's "Surgery.")

# RUPTURE (HERNIA).

BY THE LATE HAROLD BARNARD,

F.R.C.S., ETC.,

Assistant-Surgeon to the London Hospital, etc.;

AND

JAMES SHERREN,

F.R.C.S.,

Surgeon to the London Hospital; Surgeon to the Poplar Hospital  
for Accidents; late Erasmus Wilson Lecturer, Royal  
College of Surgeons.

## Head-note.

THE great danger arising from the presence of a hernia is strangulation, in which the blood-supply of the intestine contained in the sac is cut off. This, unless treated, will lead to death from acute intestinal obstruction or peritonitis.

## Technical Terms.

*Adhesion, or Band.*—An abnormal band of fibrous tissue formed as the product of old inflammation in the abdomen, and binding organs together or to the belly wall. [Fig. 113.]

*Aorta.*—The chief artery of the body. That portion of it which is contained in the abdomen is called the “abdominal aorta.”

*Appendix.*—A small tube about 3 inches long, with very thick walls. Though the thickness is about  $\frac{1}{4}$  inch, the passage is only as big as a crow-quill. It commences where the large intestine joins the small, at the right-hand bottom corner of the abdomen. The other end is loose and blind. It is a relic of the large cul-de-sac of those of the lower animals which eat grass. The grass, being very slow of digestion, rests in this piece of intestine for some days. [Figs. 9, 10.]

*Band.*—See above, Adhesion.

*Cölon.*—The large intestine, which extends from the right-hand bottom corner, up the right side, across the abdomen just below the stomach, turns down to the left-hand bottom corner, and ends in the back-passage. [Fig. 9.]

*Congenital Inguinal Hernia.*—When the peritoneal pouch (the funicular process) in the inguinal canal does not shrink before birth, as it normally does, but remains open, it forms a sac, into which part of the contents of the belly are apt to find their way, producing a rupture known as “congenital inguinal hernia.” (See below, Anatomy, Inguinal Canal.) [Fig. 161.]

*Dǎǫhrǎǫm.*—The muscular partition between the chest and the abdomen. Its contractions are part of the mechanism of breathing. [Figs. 3, 4.]

*Ĕǫǫǎǫtrǎum.*—One of the nine artificial divisions of the surface of the abdomen. It is placed in the centre, just below the breast-bone. [Fig. 1.]

*Hǎmǎǫtǎm.*—The name given to the operation of dividing the constriction at the neck of the sac of a strangulated hernia, the object being to relieve the pressure.

*Fǎrǎval Canal.*—The canal through which the “femoral” form of rupture occurs. (See below, Anatomy.) [Fig. 162.]

*Fǎmǎval Hernia.*—Escape of a rupture through the femoral canal. [Fig. 157.]

*Fǎnǎcǎlar Process.*—See Congenital Inguinal Hernia.

*Hernia, Inguinal.*—Rupture or escape of part of the contents of the abdomen into a natural or artificial pouch or sac. (See below, Anatomy.)

*Incarcerated Hernia.*—A hernia which cannot be returned to the abdomen, and along which the contents of the bowel cannot pass.

*Inflamed Hernia.*—A hernia that is inflamed.

*Inguinal Canal.*—The canal through which the indirect form of inguinal rupture occurs. (See Anatomy.) [Fig. 162.]

*Inguinal Hernia.*—A hernia which escapes along the whole of the inguinal canal (indirect inguinal), or through the external inguinal ring only (direct inguinal hernia). The indirect form may be congenital or acquired. (See below, Anatomy.) [Figs. 155, 159, 160, 161, 162, 163.]

*Ligament (in the Abdomen).*—The part of the lining of the abdomen (peritoneum) which leaves the body wall to cover a solid organ, such as the liver. It is merely a narrow strip of tissue with a layer of peritoneum on its front and back, with bloodvessels and a little fat between. (For another kind of ligament, see Joints, p. 485.)

*Mǎǎǎǎǎ.*—The part of the lining of the abdomen (peritoneum) which leaves the body wall to encircle the bowel. It resembles a frog’s foot and is a thin membrane, the front and back layers of which are peritoneum; the space between contains the vessels of the intestine and a little fat. The line along which it leaves the body wall for the small intestine is about 9 inches long, and it expands fanwise so as to cover part of the small intestine, which is 30 feet in length. [Figs. 150, 201.]

*Měšěntěric Vessels.*—Arteries, veins, and lymphatics running in that fold of the peritoneum which is called the “mesentery,” and supplying the intestine with blood. (See Mesentery.) [Fig. 201.]

*Neck (of Sac).*—See Sac. [Fig. 158.]

*Ömčěntum, Great.*—The lining (peritoneum) of the abdomen encloses the stomach in two layers (front and back), which unite at the upper and lower borders of the stomach. From its lower border these two layers are continued “apronwise” for some 10 inches and then turn upwards and backwards, enclosing the transverse colon. The apron thus formed covers the belly contents below the stomach, and is unattached below and at each side, being only fastened above. Part of the great omentum is frequently found in a rupture. [Figs. 159, 173.]

*Ömčěntum, Small.*—The lining (peritoneum) of the abdomen, as has been said, encloses the stomach in two layers, which unite at its upper and lower borders. The two layers of peritoneum which pass from the upper border of the stomach to the liver form the small omentum.

*Pělvís.*—The bony ring which forms the floor of the abdomen, the support for the body, the attachment for the legs, and the passage for the lower outlets of the body. [Figs. 203, 204.]

*Pěřítōněum.*—A smooth, glistening membrane which resembles that in the interior of the joints, and serves a similar purpose, enabling the organs to glide on each other and the abdominal wall without friction. This membrane passes from the abdominal wall to surround partially or completely the abdominal organs. The folds which it forms in its passage from the abdominal wall to the various organs are given names which differ according to their destination; thus, a fold of the peritoneum passing to a solid organ, such as the liver, is called a “ligament.” When from the back wall of the abdomen to the intestine, it is called the “mesentery.” The folds passing to the stomach are called “omenta.” (See Stomach, p. 762.) [Figs. 150-153.]

*Radical Cure.*—The operation for removing the sac and closing the opening in the abdominal wall so that the hernia may not recur.

*Reducible Hernia.*—A hernia the contents of which can be returned into the abdomen.

*Ring.*—There are three rings in connection with hernia—two inguinal and one femoral; each of these is rather a weak spot, filled in with tissues, than a definite ring. The inguinal rings are the internal and external terminations of the inguinal canal, through which the testicle passes before birth. The internal ring is an indefinite weak spot covered internally by peritoneum, and externally by the muscles of the belly wall. The external ring is a triangular opening with hard, sharply defined edges, and is an opening through the outer layer of muscle of the belly wall. In the normal adult it just admits the tip of the little finger. The femoral ring is the weak

spot which is the upper boundary of the femoral canal; it is only stretched into a ring by the hernia coming through it. [Figs. 162, 163.]

*Sac.*—The pouch or canal in which is contained the bowel, omentum, etc., forming a rupture. Its narrowest point is called its neck. [Figs. 158, 159, 160.]

*Strangulated Hernia.*—A hernia in which the blood-supply of its contents is cut off owing to compression upon its vessels. In addition, it cannot be returned into the abdominal cavity, and the intestinal contents cannot pass along it (*i.e.*, it is irreducible and incarcerated). [Fig. 164.]

### Anatomy.

A rupture is the protrusion of some of the contents of the abdomen through an opening in its wall. This most often takes place in the groin or in the region of the navel. The commonest form of rupture (hernia) is a lump in the groin or neighbourhood, which may be produced by a protrusion of a corner of the apron of the abdomen (the great omentum), or of a portion of the intestine, or of both. The rupture is contained in a bag (sac), which is a continuation of the membrane (peritoneum) which lines the whole of the abdomen. [Figs. 158, 159, 160.]

A hernia may appear in one or more of the following conditions:

Reducible,  
Irreducible,  
Incarcerated,  
Strangulated, or  
Inflamed.

When the entire contents of the hernia can be returned to the abdomen, the hernia is said to be **reducible**; and when for any reason this cannot be done, it is said to be **irreducible**.

An irreducible hernia, along which the contents of the bowel cannot pass, is an **incarcerated** or **obstructed** hernia. This condition is very likely to pass into the next to be described.

A hernia is said to be **strangulated** when not only is it irreducible and obstructed, but the bloodvessels also, which supply the intestine with blood, are compressed, and the circulation ceases, so that mortification will rapidly set in, and death occur, unless the condition is relieved by operation. [Fig. 164.]

A hernia may become **inflamed** either spontaneously as a result of infection by the micro-organisms in its contents, or after a direct injury.

There are various kinds of rupture, according to the part of the body in which they occur, which are (i.) femoral, (ii.) inguinal, (iii.) umbilical, (iv.) ventral.

Each of these hernias consists, as has already been mentioned, in the extrusion of abdominal contents, through a weak spot in the belly wall.

(i.) **Femoral Hernia.**—The weak spot is the femoral canal.

*Femoral Canal.*—The leg is supplied by a large artery and vein—the femoral artery and the femoral vein. These are ensheathed in a fibrous sheath from the interior of the belly, called the “femoral sheath.” The vein lies to the inner side of the artery, and between the vein and the inner wall of the sheath a small triangular space, about  $\frac{3}{4}$  inch long, is left. This is the femoral canal, and the roof is called the femoral ring, and is the weak spot through which femoral rupture occurs. This form of rupture is commoner in women than in men, as the femoral ring is larger in the female than in the male. [Fig. 157.]

(ii.) **Inguinal Hernia.**—The weak spot is the inguinal canal, and the hernia either passes along the canal through the internal ring and out at the external ring (an indirect inguinal hernia), or makes a short-cut through the wall of the abdomen at the lower end of the canal, and comes directly out at the external ring, thus avoiding the upper part of the canal (a direct inguinal hernia).

To exactly understand these, the first thing to examine is the inguinal canal.

*Inguinal Canal.*—In male children, in the early stages of gestation, the testicles lie high up in the back, just below the kidneys, but before birth they descend to the scrotum. They take an extraordinary journey, and travel down to, and then through, the wall of the belly. They go obliquely through the walls towards the middle line to reach the scrotum.

The upper opening, or opening of entry, is called the “internal abdominal ring.” The lower opening is called the “external abdominal ring,” and the channel between the two openings is called the “inguinal canal.”

The testicle in descending carries with it its spermatic cord, consisting of muscles, bloodvessels, nerves, and its own duct or canal. Previous to the descent of the testicle, a pouch, the funicular process, of the lining membrane (peritoneum) of the abdomen has taken the same downward course into the scrotum, forming a continuous funnel back into the belly cavity. Shortly

after the testicle has reached its proper place in the scrotum, the funnel of peritoneum shrinks, and soon becomes a mere impervious thread, but the two openings through the belly wall henceforth remain as weak spots. It is through these weak spots that rupture (hernia) is most liable to occur. [Figs. 159, 160, 161, 162.]

1. *Indirect or Oblique Inguinal Hernia*.—An indirect inguinal hernia passes from the belly at the internal abdominal ring, traverses the whole length of the inguinal canal, and reaches the surface through the external abdominal ring. These indirect inguinal hernias are classified into congenital and acquired. [Figs. 155, 161.]

(a) *Congenital Inguinal Hernia (Indirect)*.—By a congenital inguinal hernia is meant a rupture that descends into a sac ready formed for it, due to imperfect obliteration of the peritoneal process (funicular process) mentioned above. A congenital inguinal hernia may first make its appearance in middle life, notwithstanding that the sac has been present from birth. [Fig. 161.]

The majority of cases of inguinal hernia are congenital, the predisposing cause being the presence of the sac due to the imperfect closure of this canal or funnel (funicular process) that descends into the scrotum before the testicle. (See Inguinal Canal.) This failure of closure may be complete, so that the intestine on its first descent may reach the bottom of the scrotum; the canal may be closed just above the testicle or anywhere throughout its length. The actual exciting cause of the rupture is increase of pressure in the abdomen, usually of long duration. A predisposing cause is the weakness of muscles around the canal.

In some instances a sudden strain may bring down a rupture into a canal or funnel (sac) that is *congenital*, but this sudden appearance never occurs in *acquired* indirect inguinal hernia.

Inguinal rupture is often associated with imperfect descent of the testicle, the testicle remaining in the abdominal cavity or in the inguinal canal. In these cases the canal or funnel (funicular process) always remains open.

(β) *Acquired Inguinal Hernia*.—A true acquired inguinal hernia is rare. It is of gradual onset, and is a slow yielding of the outer wall of the canal in the region of the internal abdominal ring, with the result that a sac is formed as the muscles gradually yield. An acquired indirect inguinal hernia, unlike the congenital hernia, *never* appears suddenly as the result of a strain. [Fig. 160.]



2. Direct Inguinal Hernia.—This is due to yielding of the inner wall of the inguinal canal opposite the external abdominal ring, the rupture passing directly outwards. It is rare before forty, and is unknown in women. It is true that it is said that this form of rupture may occur suddenly as the result of a strain. I have never known it to occur, and personally do not believe in it. It appears quite gradually. It is always acquired, for there is never a congenital sac waiting for its reception. It is an uncommon hernia, and does not constitute more than 5 per cent. of all inguinal ruptures. [Fig. 156.]

(iii.) **Umbilical Hernia, or Hernia at the Navel**.—This occurs in the region of the navel, and is very common in infancy, when it is due to the yielding of scar at the navel. It is also common in women who have borne children.

It is only in children that the yielding of the abdominal wall takes place actually through the navel. This is usually due to abdominal distension, such as results from intestinal disturbance in children. A hernia so arising very rarely persists until adult life.

In adults umbilical hernia occurs above or below the navel, usually the former. It is more common in women who have borne children, owing to the weakening of the muscles during gestation. It is nearly always irreducible, and is liable to attacks of obstruction, which may go on to strangulation.

It appears gradually, and never suddenly as the result of accident.

(iv.) **Ventral Hernia**.—This is the name used to describe ruptures through the abdominal wall elsewhere than in the region of the navel.

There are two important varieties: (a) epigastric; (β) post-operative, or ventral.

(a) *Epigastric*.—These commence as small protrusions of the fat which is situated between the lining (peritoneum) of the abdomen and the muscles of the abdominal wall, through openings acquired or congenital in the mid-line of the belly above the navel, or about 2 inches to the right or left of the middle line (just outside the rectus muscle). In their growth these protrusions drag out a small funnel of peritoneum, into which some of the contents of the abdomen may pass, and so they may be the starting-point of even large hernias. They are very painful. It is doubtful if they have ever originated from accident.

(β) *Post-Operative or Ventral Ruptures*.—These may occur in

any part of the abdominal wall after wounds the result of accident or operation.

There are two factors of importance in their production: the division of muscle across the direction of their fibres; and inflammation of the wound during the course of healing. (See Abdomen.)

### Consequences of Accident.

The various kinds of hernia are described above, under Anatomy.

Blows on the spot where rupture appears are popularly supposed to be the cause of rupture, but this is a fallacy. A blow on a previously existing rupture may lead to inflammation or strangulation, but is never the primary cause of rupture.

A new hernia rarely, if ever, results from an accident. Ruptures alleged to be caused by an accident may be classed under one of the following four heads:

1. There is an old rupture, upon which the accident had no effect, and of which the man may state he was unconscious; but it is hard to believe that he was not aware of some local mischief, if only a lump, especially as it is usually in the groin, and may cause inconvenience to him in walking, etc.

2. There is an old rupture made worse by the accident.

3. There is a new rupture produced. (For the probability of this, see below, Diagnosis and Malingering.)

4. There is no rupture at all. The man says he has been ruptured, and shows a lump in the groin, which is most commonly a lymphatic gland enlarged by some infection, usually of the genital organs.

The following are the ways in which rupture can occur, but it must clearly be remembered that a very large number of ruptures arising from accident are really aggravations of old ruptures. (See below, Malingering.)

(i.) **Femoral Hernia.**—In this the weakness predisposing to the formation of a femoral hernia is found in the femoral ring, with perhaps, in some cases, a sac already formed. The sudden genesis of a femoral rupture, as the result of an accident, is an event of very great rarity, if it can occur. [Fig. 157.]

(ii.) **Inguinal Hernia.**—See above, Anatomy—Inguinal Canal.

*Indirect or Oblique Inguinal Hernia.*—Where a congenital weakness exists due to the ready-formed sac, caused by the imperfect closure of the peritoneal funnel, combined in some

cases with weakness of muscle, a congenital form of inguinal hernia results, in which the onset may occasionally be sudden, as the result of an accident (*vide supra*, p. 692). When such an inguinal hernia appears suddenly as the result of an accident, it may at once become strangulated. [Fig. 155.]

*Direct Inguinal Hernia.*—This has probably never occurred as the result of accident. (See above, Anatomy—Femoral Cause.) [Fig. 156.]

(iii.) **Umbilical Hernia.**—In this, so far as is known, rupture never appears suddenly as the result of an accident.

(iv.) **Ventral Hernia** does not develop suddenly as the result of an accident.

#### Disease.

1. **Caused by the Accident.**—Hernia once formed may assume either of the following conditions :

(a) **Reducible.**—It may remain an ordinary reducible hernia, and return to the abdomen without difficulty, or with some slight degree of manipulation, of which the man himself is quite capable. For no obvious cause, perhaps owing to slight constipation or indigestion, the hernia takes an unfavourable turn, and then it may become one or more of the following :

(b) **Inflamed.**—A hernia becomes inflamed spontaneously—*i.e.*, for a cause that cannot be discovered, which is an infection from within the bowel—or the inflammation may be the result of an accident.

In this condition inflammation exists in the sac. In some cases the inflammation has spread from some point near, such as an inflamed appendix.

Where it is due to a blow or accident, it is not of such grave importance, as the formation of matter (suppuration) rarely occurs. A rupture which has been unsuccessfully and severely handled for some time, in efforts to reduce it, is always the seat of inflammation.

(c) **Irreducible.**—A hernia has become irreducible when the contents are no longer capable of being put back into the abdomen. In consequence a truss cannot be worn, or, if worn, is useless as a means of preventing strangulation. A patient with an irreducible hernia is in constant danger. In most irreducible hernias the cause of the irreducibility is the formation of adhesions between the contents and the wall of the sac. This is especially common in hernias containing omentum. In other cases the irreducibility is due to gradual or rapid increase in size of the hernia. In slight cases of this nature

skilful manipulation without an anæsthetic is sufficient to reduce the contents. Other cases require rest in bed, with the hips elevated for a day or two, before the contents can be induced to return. In severe cases a full anæsthetic, or even an operation, may be necessary to bring about this result.

In all cases in which the irreducibility is due to adherent omentum operation is required, for this type of hernia cannot be controlled by a truss, and is liable to become strangulated.

(*d*) **Incarcerated.**—This only occurs in hernia of the bowel, and the hernia becomes incarcerated when not only will it not return to the abdomen, but the intestinal contents cannot pass through the loop of the intestine into the sac. As a result the patient suffers from severe colic (gripes) and constipation, which may be absolute, so that no motions are passed. Relief can only be obtained by a similar line of treatment to that mentioned above under Irreducible Hernia, but the case is more urgent, and must be dealt with immediately. An operation is usually advisable.

(*e*) **Strangulated.**—A common consequence of accident affecting a previously existing hernia is that the rupture comes farther down into the sac, becoming strangulated. In this condition, not only can it not be reduced and nothing pass through the coil of the intestine in the sac, but the blood-vessels are compressed and obstructed, so that, unless the rupture is soon released from pressure, mortification will set in. The patient suffers from severe pain and the most distressing vomiting, while his life is in great danger. Very little time should be wasted over the preliminary methods of the treatment already narrated. If five minutes' manipulation without an anæsthetic does not reduce the contents of the strangulated hernia, then an anæsthetic must be given and the contents reduced by an operation, which consists in dividing the constriction (herniotomy). In some cases in which gangrene (mortification) is present, it may be necessary to remove portion of the bowel affected. [Fig. 164.]

2. **Existing before the Accident and aggravating its Effects.**—See below, Diagnosis.

- (*a*) An old hernia rendered worse.
- (*b*) Congenital conditions.
- (*c*) Hereditary tendency.
- (*d*) Weakness.
- (*e*) Emaciation.

- (f) Obesity.
- (g) Belts.
- (h) Tumours, pregnancy, and dropsy.
- (i) Obstruction of excretion.
- (j) Chronic cough.
- (k) Scars.

(a) **An Old Hernia rendered worse.**—An accident may cause a previously existing hernia to undergo serious complications. When this occurs, the patient is generally suffering from a reducible hernia, which is held up by a truss. In consequence of an accident the hernia may come down, and becomes either irreducible, incarcerated, strangulated, or inflamed.

These conditions have already been described above. In a very few cases a blow or accident on the hernia has caused inflammation of the contents of a rupture and even to bursting of the contained bowel. In such a case the tissues over the rupture will probably show a bruise.

(b) **Congenital Conditions.**—The commonest of all pre-existing conditions is the existence of a congenital funnel or sac at the groin. This condition is present at birth in many male babies, and probably in a number of female babies, though in them it is always smaller; but the neck of the sac in both sexes becomes shut off in the great majority of cases during childhood. In a number of cases, however, in both sexes, it persists into adult life, and then a gradual or (more rarely) a sudden strain may cause the abdominal contents to descend. In males the contents may at once reach the bottom of the scrotum and surround the testicle, in which case the hernia is clearly a congenital one. A similar accident may occur in women, the rupture descending into the outside parts (labium). But in most cases the canal or funnel of peritoneum is obliterated entirely to a great extent. (See under Inguinal Hernia.) [Fig. 161.]

(c) **Hereditary Tendency.**—A hereditary predisposition to rupture is well marked in some families.

(d) **Weakness.**—Conditions which weaken the abdominal wall predispose to rupture, especially long-continued illnesses, such as typhoid, influenza, scarlet fever, blood-poisoning, severe cases of pneumonia, and, indeed, any fever of long duration. Thus, a young athlete who was convalescing from scarlet fever ruptured himself whilst bowling at the first game of cricket he was allowed to take part in at the convalescent home.

(e) **Emaciation.**—Many old men and women acquire ruptures when they become emaciated, and the same applies to all long and wasting illnesses at any age.

(f) **Obesity.**—On the other hand, increased fatness is a common cause of hernia, especially of umbilical hernias in women. Fat is deposited in the muscles, and weakens them, and thus disposes them to yield more easily under strain.

(g) **Belts.**—Abdominal belts may aid in the causation of rupture. They compress the abdomen at its central part, where rupture can scarcely occur, and direct the abdominal contents with increased pressure against the weak spots below.

(h) **Tumours, Pregnancy, Dropsy.**—In a somewhat similar way pregnancy, dropsy, and large abdominal tumours, increase the internal pressure of the abdomen.

(i) **Obstruction of Excretion (Constipation and Urinary Obstruction).** (j) **Persistent Cough**—Chronic constipation, urinary obstruction of old men caused by enlarged prostate, or persistent cough, commonly produce ruptures by constantly repeated small straining efforts. These ruptures are often fraudulently attributed to a sudden accident.

(k) **Scars.**—The sudden formation of a hernia through an old scar as the result of an accident is a very rare occurrence. Where a surgical operation is necessitated by an accident, the resulting scar in the abdominal wall may give way under internal strain, and produce a ventral hernia. A wound from a stab might act in a similar way. (See above, Ventral Hernia and Abdomen.)

### Operation.

The necessity for operating, and the risks run by the patient, are determined by various conditions.

1. **Age.**—The very old should not be operated upon if it can be avoided, but even quite old persons have successfully undergone operation. Infants suffer from inguinal and umbilical hernias, each of which is frequently completely cured by an efficient truss, a contrast with adult hernias, which are controlled, but are not cured, by a truss.

2. **The Conditions of the Hernia** which may render an operation necessary or advisable are that it is—

- (a) Strangulated.
- (b) Irreducible.
- (c) Demanding a radical cure.

(a) *Strangulated Hernia*.—This is necessary, and must be done at once, or the conditions will prove fatal from mortification of the part of the rupture beyond the constriction. [Fig. 164.]

The immediate operation that is necessary may be quite a small one. A cut is made through the constricting ring (herniotomy). This allows the pressure to be relaxed, and the blood once more to circulate. Success depends on the time of the onset of the disease that the operation is done. If there is no delay, the rupture may be simply returned into the abdomen, and the operation for radical cure performed at the same time; but if there be a long delay, this operation may be too late: for if the compressed rupture has already begun to mortify, then after its return to the abdomen it may not recover. If this dead portion of bowel is not removed, a fatal termination is inevitable. A radical cure can be done at the same time, for which see below.

(b) *Irreducible*.—This may arise either from the increased bulk or from adherence of the contents of the rupture of the sac.

If a hernia is irreducible, the usual reason is because it contains omentum which is adherent to the sac. This condition renders control of the hernia by a truss impossible, and places the patient in constant danger of strangulation of the rupture.

If the operation is performed for an old irreducible hernia because of the bulk of its contents, as in such cases the hole in the abdomen is very large, it may not be possible to entirely close it, and so obtain a cure; but the patient by wearing a truss can prevent the formation of another large hernia through the same hole. (See Radical Cure.)

(c) *Radical Cure*.—Operation is done in many other cases in order that the patient may be saved the necessity of wearing a truss, or because it is not well controlled by the truss.

This is a very common operation, and may be performed after a strangulated hernia has been relieved, or because a hernia is irreducible. After returning the contents of the sac into the abdomen, the sac is removed or stitched up; and the hole which allowed the descent of the bowel is also closed, thus restoring the normal condition of the part. These operations are usually very successful, and not specially dangerous. The risk of the operation is negligible in the hands of a competent surgeon; it is  $\frac{1}{5}$  of 1 per cent.—*i.e.*, 1 in 500—and is very little more fatal than removing a finger.

When the operation is successful, the man is well and strong afterwards.

3. **The Nature of the Hernia.**—(a) *Inguinal or Femoral.*—If not too large, these can always be operated upon.

(b) *Ventral.*—These rise in the scar of an old wound, and there is no reason against operation, except the probability of recurrence.

(c) *Umbilical.*—For infants rarely, if ever. For adults the operation should always be performed early, as these hernias always become irreducible, often strangulated.

### Cure.

The cure of a rupture arises from two lines of treatment :

1. Truss.
2. Operation.

1. **Truss.**—Absolute cure is only possible in the case of infants, but, if it be a properly fitting one, a truss enables men to work at light labour with comfort, and even ease. But the truss closes the walls of the canal and keeps the rupture back in the abdomen only as long as it is applied.

Many people with a hernia, by wearing trusses, pass through life with comfort. They are, however, careful, regular, and cleanly people, who keep their trusses in good repair and only remove them when they are recumbent in bed, and replace them in the morning before they arise. Clerks and sedentary workers, and even people who do light work, such as domestics, may do very well under these circumstances. In a few nervous and sensitive people the existence of a rupture, even when it is always held up by an efficient truss, gives a sense of insecurity, with loss of activity and mental vigour, amounting in some cases to a continuous depression of spirits. Some of these people are entirely cured by an operation.

Where the patient is careless, ignorant, or dirty, and especially where he performs heavy work, a hernia kept up by a truss is a continuous disablement, liable at any time to become a danger to life, and necessitate an immediate operation for strangulation. The rupture is constantly coming down under the truss, or, when it is not worn, the neck of the sac becomes larger, and the rupture bigger at every descent.

Moreover, the chances of a successful radical cure diminish as the hernia grows bigger. Finally the hernia becomes irreducible, and an efficient truss cannot be worn at all. It is



then only a matter of time before strangulation compels an operation under very adverse circumstances.

2. **After Operation.**—After a radical cure, the patient should remain in bed for from fourteen to twenty-one days. During a further three weeks he should practise graduated exercises. For a further six weeks he may do light work. After three months he may perform any of the work of which he was formerly capable. Many patients, however, return to their former heavy work without inconvenience within six weeks of the operation. For a long time the scar may ache a little when the weather changes, especially if the patient is nervous and sensitive.

### **Return to Work.**

A man cannot safely engage in laborious work with an untreated hernia, for the danger of its increasing is so great as to render it most unwise for any man to run this risk, although it is constantly done by the uneducated. A truss enables most men to work for years, and employers would be surprised at the number of their employees who are wearing trusses and doing really heavy work.

After operation the man can return to work in under three months. A little pain in the scar is commonly complained of, but that is negligible as an interference with work. It is only in less than 5 per cent. of the cases operation fails to cure.

### **Recurrence.**

Except in less than 5 per cent. of the cases there is no tendency in a cured hernia to recur after it has been operated upon. In ventral hernia there is a risk of recurrence.

### **Occupation Diseases.**

There is no actual occupation which specifically produces hernia. Continuous strain, especially where the breath is held and the pressure in the abdomen is raised, may gradually lead to hernia, no matter what the work is.

All labour requiring heavy lifting, such as that of retort men, stokers, builders, stone-masons, porters, is specially conducive to rupture from holding the breath, and so pressing on the abdominal walls.

Long-continued heavy strain on the abdomen from expiratory efforts, as of players on wind instruments, glass-blowers, etc., produces the same effect.

The following is the instructive finding of the Departmental Committee on Compensation for Industrial Diseases:

“Hernia is never the result of a series of strains undergone in the course of employment, and cannot be regarded, among workmen in any trade, either as an industrial disease or as an injury, not being an accident, due to their employment” (Report of Departmental Committee on Compensation for Industrial Diseases, 1907, p. 22).

### Diagnosis.

There are five points to be considered in determining whether or not a man's statement is true that he is ruptured through the accident he describes:

- (i.) The causes of rupture generally.
- (ii.) The presence of rupture. Is the man ruptured?
- (iii.) Is the rupture recent or old?
- (iv.) If recent, was it caused by the accident described?
- (v.) If old, has it been rendered worse by the accident as described?

(i.) **The Causes of Rupture generally.**—The present teaching in medical schools is that inguinal hernias are the result of a gradual long-continued strain, which slowly opens up the small trace of the congenital sac or process left in the inguinal canal. (See Anatomy—Inguinal Canal.) A corner of the apron of the abdomen (the omentum) gets pushed down gradually into this canal. In this case the usual complaint of feeling “something giving way” is of course absent. In fact, it may be doubted if that “something giving way” often occurs except in the case of the first appearance of a complete congenital hernia. In this case, the rupture when it first occurs slips straight into a large sac already formed.

Intermittent increase of pressure within the abdomen is the cause of most ruptures, coupled with a weakness of some spot of the abdominal wall. Under the head of Anatomy above, the commonest weak spots are described. They are the inguinal canal, femoral canal, the neighbourhood of the umbilicus, or navel, and scars across abdominal muscles (ventral hernia).

Under the head of Disease—(2) Existing before the Accident and aggravating its Effects are mentioned numerous conditions which render a man predisposed to rupture, but the presence of some of them is far more likely to have produced the rupture than to have rendered the effects of accident more severe.

All laborious occupations tend to gradually produce hernias.

The heavy work long continued, especially with the patient holding the breath, raises the internal abdominal pressure, which affects some weak spot in the abdominal wall, and slowly and persistently stretches it, so that a hernia forms here by degrees until it is large enough to attract the attention of the patient. Chronic constipation and urinary obstructions also raise the pressure of the abdomen, and are also a cause of rupture.

Cough, especially the winter cough of the aged, which is so frequently associated with emaciation and loss of muscular power, is also a very common cause of rupture.

(ii.) **The Presence of a Rupture. Is the Man ruptured?**—At every point in the abdominal wall where a rupture occurs there are conditions which simulate it, such as fatty tumours, dilated veins, and enlarged glands. These conditions, which may be wrongly attributed to an accident, are usually mistaken for a rupture by the patient.

*Glands.*—The recognition of a hernia is not, as a rule, a difficult matter. It might be confused with other swellings in the groin, such as enlarged glands associated with venereal or other disease; but this is an error which no competent surgeon could ever make, except in the case of a small, irreducible femoral hernia.

In this particular case considerable difficulty may arise, and it may be impossible to make a certain diagnosis without an operation. This type of hernia, however, does not arise as the result of an accident, and it is an irreducible hernia owing to adherent omentum.

(iii.) **Is the Rupture Recent or Old?**—The following are the signs of a rupture of long standing:

1. *Size.*—A large hernia is usually an old hernia; by that is meant it has not come into existence recently. But sometimes a very large hernia does increase suddenly, owing to a strain.

2. *Contents.*—Recent hernias almost always contain bowel as opposed to omentum. A hernia which contains adherent omentum is an old hernia. [Fig. 159.]

3. *Ring.*—What follows applies only to inguinal hernias.

The hole through which the hernia leaves the abdomen is called the ring. Normally there are two, the “external” and the “internal.”

Three changes happen to the rings in old ruptures. There are alterations in the diameter, in the position, and in the texture of edges.

(a) *Diameter of Ring*.—The rupture stretches the ring and makes it larger, so that a large ring is the ring of an old hernia.

(b) *Position*.—There is a small canal,  $1\frac{1}{2}$  inches in length (the inguinal canal), which normally separates the two rings, the external from the internal. When the rupture descends into the pouch (or sac), which it may make itself by pushing the structures before it, or which exists ready for it (congenital hernia), the stretching of the parts pulls down the upper internal ring. The result is that the rings, instead of being  $1\frac{1}{2}$  inches apart, are brought near together.

(c) *Texture*.—The edges of the rings in an old hernia become thickened.

4. *Sac*.—The bag, pouch, or sac, into which the rupture pushes its way, is made of the lining of the abdomen (the peritoneum). This is a highly elastic, thin membrane, which at first resists the descent of the rupture, be it bowel or omentum; but as this resistance is overcome, the walls give way, and after a long time they become thickened by inflammation. There are two kinds of inguinal hernia—the congenital and the acquired. In the congenital form the bag is always there to a greater or less degree, through having been left, as is described above. (*Vide* Technical Terms—Hernia, Inguinal.) This congenital sac is much thinner than the one caused by the pushed-out peritoneum of an acquired rupture. Thus, in a congenital hernia with a thick-walled sac there is a still clearer indication of age than would be were it an acquired hernia. [Figs. 158, 159, 160, 161.]

5. *Adhesions*.—The omentum in an old rupture commonly adheres to the walls of the sac. [Fig. 159.]

6. *Skin*.—Discolorations of the skin from friction of a truss are often seen in old hernias. These are found at the points where the friction of the truss upon the skin has been greatest. Moreover, where the pad of the truss presses in front the skin is often thin and the hair rubbed away.

(iv.) **If Recent, was it caused by the Accident described?**—The opinion of all surgeons of experience is that hernia as the result of accident only arises in very few cases. Most of these are inguinal hernias of the congenital type. In some places in the body hernia due to accident is unknown. (See Malingering.)

(v.) **If Old, has it been rendered worse by the Accident as described?**—If a workman has had an old rupture, which he

claims has been made worse by accident, and has refused to wear a truss or declined operation, it is hard to see that this aggravation is an accident, for it is exactly what one would expect to occur; for if a hernia is not protected by a truss, it it will inevitably increase in size.

### Malingering.

Rupture is exceedingly common. The layman has no idea how common, or how much daily laborious work is performed by working men with a rupture. The capacity for work of a ruptured man who wears a truss is very considerable, but it is astonishing what very heavy manual labour is daily performed by men who have no truss to keep back their rupture. The man gets the knack of adjusting his muscles into such a position that the strain of his work is not felt directly by the rupture, and in consequence he continues his laborious toil under circumstances that appear improbable to the medical man and impossible to the layman. It is not for one moment denied that a man who works under such circumstances is exposing himself to grave risk in making his hernia much worse, but the fact still remains that the workman goes on working. There is probably more fraud connected with claims for rupture produced by an accident than can be found in all the other cases of fraud for the rest of the body. Of the cases that claim compensation for damages for hernia as being caused by a *sudden* strain, probably not one in ten is genuine.

The Departmental Committee on Compensation for Industrial Diseases in connection with the Workmen's Compensation Act, 1906—the same Departmental Committee that recommended the addition to the schedule of all the diseases that were subsequently added by the Secretary of State's order to the schedule of that Act—in their final report made the following important statement: "The evidence which we have received from authorities of eminence is definitely to the effect that hernia may, though very rarely, be due to a sudden strain; in which case it would be the subject of compensation, if caused by the employment, as an accident. But what usually happens is that some cough or particular strain brings down a little farther a hernia, which has been slowly developing, so as first to make it prominent and attract attention."

It is perfectly true that under the Workmen's Compensation Act a master is liable for an accident which has rendered a workman incapable of work. It does not matter how trivial

was the accident, or how near to total incapacity the man was before he met with the accident, still, by this Act the master is liable for the combined result of accident and disease. A hernia from which a man has suffered the whole of his life, and to retain which he has always worn an efficient truss, is held to have been rendered worse during the work of the workman on a particular day. There may be nothing unusual about the man's work, and the real cause of the trouble is that on the day in question he did not wear his truss. His hernia becomes suddenly worse, and the master has to pay him compensation for the rest of his life.

It would be well for every employer of labour if every workman were examined at least once a year for hernia. The existence of a hernia, or even of an unusually weak spot tending to produce a hernia, would then be discovered, and means could be taken accordingly. The master would at least be protected from having to defend a claim that a congenital hernia possessing all the characteristics of an old hernia (mentioned above under the head of Diagnosis) had been produced by the accident a month previously.

There are three forms of malingering in connection with hernia :

1. *An Old Hernia :*

The first and most common is that a man has sustained a rupture for the first time, when in fact he has an old rupture. Certain signs which indicate that a rupture has existed for some time are to be discovered by an ordinary examination, but the most conclusive signs are only discovered at an operation. (See above, Diagnosis.)

If a truss has been worn, then the skin, as has been already mentioned on p. 704, is commonly, but not always, stained, denuded of hair, and thin. If a rupture has recently been protruded from the abdomen, the sac is as thin as tissue-paper and transparent. An old sac is thick, opaque, adherent to the surrounding structures, and, especially in the case of femoral rupture, may be formed of several layers. The ring or hole in the abdominal wall through which the rupture passes, or, as it is also called, the neck of the sac, undergoes characteristic changes as time goes on. It becomes circular, with a thick rounded edge, and is displaced by gravity to a lower position. The condition of the contents as revealed at an operation are the most certain and conclusive evidence that a rupture has

existed for a long time. Intestine which has long ago descended into a hernial sac becomes thickened, whilst its mesentery is swollen. The apron of the abdomen (omentum), which has long ago descended into a hernial sac, changes from a delicate membrane to thick, brawny and matted masses containing swollen veins. It often adheres to the sac by a white fibrous scar tissue, which must be of many months', or even years', duration. Another slow change which occurs in the omentum is that a mass of firm fat grows on its farther end in the bottom of the sac. This mass is often much larger than the neck of the sac, and therefore cannot have passed through it in either direction for a long time.

### 2. *An Aggravated Hernia :*

The second form of malingering is much more subtle, and is that a hernia which a man admits he had for a long period has been rendered worse by the accident without any sudden strain. The repetition of daily work of a laborious kind naturally tends to make a hernia worse, and the fact that it eventually reaches a condition which is so serious as to require an immediate operation is a perfectly natural sequence of this diseased condition. The Judges and arbitrators ought to be far more on their guard against claims that a hernia has been rendered worse by an accident. The evidence is extremely unsatisfactory, and the man should be made to prove up to the hilt his statement that he has been made worse.

A person who has been ruptured by an accident or by the nature of his employment may exaggerate, or even deceive others as to the degree of the incapacity caused by the rupture. This incapacity is, however, a very difficult matter to estimate, as it varies with natural pluck of the individual, the energy of his temperament, and his nervous constitution.

### 3. *Persistent Incapacity after Operation :*

The third form of malingering is that of incapacity after an operation. Where the contents of the abdomen no longer protrude through the walls, the man should be regarded as cured by the end of the period of time allowed for rest before he returns to work, and he should not be permitted to exaggerate dreadful sensations of pain which do not incapacitate him from work.

A radical cure of hernia is often mechanically successful, but the patient may complain of pain in the scar, especially at changes of weather.

This subject is closely connected with the whole matter of neurasthenia, hypnotic suggestions, fixed ideas, and even delusions.

The patient has very probably had a severe accident, for which some operation with its associated mental strain has been necessary. His attention has been unduly directed to the particular part of his body involved, and he has concentrated his mind upon that part for weeks or months. If he were to return to work as soon as he was medically fit, fresh interests and the cares and demands of his toil would soon restore his attention to a normal balance, and he would cease to have any pain or discomfort in the part.

The usual history is, however, that he passes from the hands of the medical man who has attended him into those of the lawyer. It is clear that, if he is to get substantial damages, he must not recover health before the proceedings are over, so days of idleness follow in which he meditates on and nurses his trouble, insists on his incapacity, and tries to convince himself—often very successfully—that he is permanently incapacitated and a great sufferer. His own medical experts examine him thoroughly, and write reports on him, and unconsciously suggest to his imagination other symptoms which help his case. It is really not surprising that six months of such a process will produce a fixed idea, a feeling of incapacity to work, or even an actual delusion, from which the man is often unable to free himself when his case and damages are finally settled.

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*For legal cases of Rupture, see CASE GUIDE: Rupture.*

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## SAPRÆMIA, SEPSIS, SEPTICÆMIA.

*See* INFECTION.

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## SARCOMA.

*See* BONES, BREAST, ACCIDENTS IN CHILDHOOD—BONES.

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## SINUS OF BRAIN AND FACE.

*See* BRAIN AND NOSE.



# THE SKIN.

By J. M. H. MACLEOD,

M.A., M.D., M.R.C.P.,

Physician for Diseases of the Skin, Victoria Hospital for Children; Assistant-Physician for Diseases of the Skin, Charing Cross Hospital; Lecturer on Skin Diseases, London School of Tropical Medicine; Co-Lecturer on Skin Diseases, Charing Cross Hospital Medical School; Editor of *British Journal of Dermatology*.

## Head-note.

THE consequences of injury to the skin may be classified under the following six heads:

- (a) The area of skin injured.
- (b) The depth of skin injured.
- (c) The infection of the wound.
- (d) The contractures from the scars.
- (e) Disfigurement from pigment remaining at the site of injury.
- (f) New disease arising in the scar.

## Technical Terms.

*Abrasion*.—Loss of surface of the skin through rubbing or scraping.

*Ācārus Scābiei*.—The minute insect of the class Arachnidæ (or spiders) which causes the itch, or scabies, by the burrowing of the pregnant female into the skin to lay her eggs.

*Ācnē*.—An inflammation of the hair follicles associated with the presence of "blackheads" (*vide* Comedo) and matter.

*Āctīnōmycōsis*.—An affection of the skin due to the "ray fungus," characterized by nodules which tend to break down and form slowly healing sinuses, in the discharge from which the fungus may be detected in the form of yellowish granules.

*Ālōpēcīa*.—Baldness.

*Ālōpēcīa Areata*.—An affection of the hairy system in which patches of complete baldness occur without marked alteration in the skin.

*Anthrax*.—*Vide* Malignant Pustule.

*Barber's Itch*.—See Sycosis.

*Büllä*.—A bleb.

*Cärbüncle*.—An inflammation of the skin and subcutaneous tissue which ends in suppuration and sloughing, and is associated with constitutional symptoms.

*Cheloid*.—Fibrous new growth of the skin resembling an old thick scar. (Also called "keloid.")

*Cömädö*.—A "blackhead," a plug of retained secretion and cells blocking the opening of the hair follicle.

*Cörüum*.—The part of the skin beneath the epidermis.

*Dermätitis*.—Inflammation of the skin.

*Dësquamation*.—The shedding of the superficial layer of the skin, in scales or sheets.

*Ëczéma*.—An itching inflammation of the skin generally characterized by the presence of weeping or crusted patches.

*Ëpidermis*.—The outer layer of the skin.

*Ërythéma*.—Redness of the skin which disappears temporarily on pressure.

*Excoriation*.—Superficial lesion (injury) of the skin due to scratching.

*Föllicle*.—A little pouch or sac-like structure in the skin — *e.g.*, hair follicle, a little sac in which lies the hair.

*Herpēs*.—An inflammatory disease of the skin characterized by groups of vesicles.

*Herpēs Zöster*.—Shingles; a form of herpes occurring in patches, especially in the skin over the ribs. (Also called "zona.")

*Horn Cells*.—The most superficial cells of the epidermis.

*Hýperämia*.—Redness of the skin due to increased flow of blood to the skin.

*Hýperæsthësia*.—Increased sensibility.

*Ïchthýösis*.—A dry, scaly condition of the skin of congenital origin, generally becoming evident during the first year.

*Ïmpëtigö*.—An inflammation of the skin due to the inoculation of pus (matter) organisms, generally associated with the presence of matter and scabs.

*Incubation Period*.—The interval of time between the inoculation of the microbe of disease and the appearance of well-defined symptoms. It is the period during which the microbes are multiplying themselves and their poisonous excreta sufficiently to produce those changes in the body which manifest themselves as the symptoms of the disease.

*Keloid*.—See Cheloid.

*Kerviön*.—Ringworm of the scalp associated with suppuration (matter).

*Lūpus Ērýthēmātōsus.*—An inflammation of the skin characterized by the presence of circumscribed reddish patches, covered with adherent scales and associated with thinning of the skin.

*Lūpus Vulgaris.*—A slowly advancing inflammation of the skin characterized by pinkish-brown nodules or patches, which tend to ulcerate and are due to the virus of tuberculosis.

*Malignant Pūstūle.*—The skin lesion caused by the inoculation of the virus of anthrax.

*Nævus.*—Birthmark.

*Pāpūle.*—A small elevation of the skin.

*Pēdiculōsis.*—Skin disease due to lice (pediculi).

*Pēmphigus.*—An inflammation of the skin characterized by bullæ or blebs.

*Prūritus.*—Itching of the skin.

*Psoriāsis.*—A chronic inflammation of the skin characterized by dry red patches, covered with silvery scales. An exceedingly common skin disease.

*Purpura.*—Bleeding into the skin resulting from disease.

*Pūs.*—Matter.

*Pūstūle.*—An elevation of the skin containing matter (pus).

*Ringworm.*—A disease of the skin or hair caused by the growth of a special fungus or mould.

*Sēbācēous Glands.*—The oil glands which lubricate the hairs.

*Sēbōrrhæa.*—An affection of the sebaceous glands characterized by excessive secretion of the sebum.

*Sēbum.*—The secretion of the sebaceous glands—a semi-fluid substance composed of fat and broken-down epithelial cells.

*Sēpticēmīa.*—A condition produced by the entrance of septic matter into the blood.

*Suppuration.*—Formation of matter (pus).

*Sýcōsis.*—An inflammatory affection of the hair follicles of the beard region. There are two varieties, one being due to the fungus of ringworm (*Tinea barbæ*), and the other to the pus microbes. As some cases are caused by the inoculation of the virus by a barber in shaving, sycosis is popularly known as “barber’s itch.”

*Tīnĕā Barbæ.*—Ringworm of the beard.

*Tīnĕā Circinata.*—Ringworm of the body.

*Tīnĕā Tonsurans.*—Ringworm of the scalp.

*Urticāřia.*—An eruption of wheals with itching; nettle rash.

*Vĕsicle.*—A small elevation of the skin containing clear fluid (serum).

### Anatomical and Physiological Considerations.

The skin anatomically consists of two distinct parts—namely, the epidermis, or outer layer, and the corium, the underlying fibrous layer.

**Anatomy of the Skin.**—The epidermis, or outer layer of the skin, is a pliable layer which covers the whole of the body except the eyes, and is continuous with the moist lining layer (mucous membrane) at the different natural orifices. The cells of the deepest layer are regular in shape, and are the “mother cells” from which the epidermis grows; the most superficial layers of cells have a horny envelope, and in consequence are named “horn cells,” are closely knit together like a mosaic, and form a protective layer. In connection with the epidermis and developed from it are the skin appendages, the hairs with their fat (sebaceous) glands to lubricate them, the sweat glands, and the nails. The sweat glands are distributed nearly over the whole skin.

**Corium.**—Beneath the epidermis is the corium, which is a fibrous structure supporting the bloodvessels which nourish the skin, and the nerves which regulate the growth and render it sensitive. Underneath the corium is a layer of fat cells which supports certain delicate nerve terminations, small bloodvessels, etc. The fat, being a bad conductor, preserves the heat of the body.

**Physiology or Functions of the Skin.**—The skin in health performs six important functions—namely, those of (1) protection, (2) excretion, (3) heat regulation, (4) perspiration, (5) sensation, (6) absorption.

1. *Protection.*—It is the superficial layers of the skin, consisting of horn cells, which perform this function, and so long as these layers are intact it is possible for the skin to be in contact with even virulent microbes and poisons without their penetrating into the blood. On the other hand, should even a slight abrasion of the surface occur, or the power of resistance of the skin be lowered by disease, penetration may take place.

2. *Excretion.*—The excretory function of the skin is vested in the sweat glands, and by them a number of effete and deleterious substances are eliminated from the blood and lymph.

3. *Heat Regulation.*—The constant temperature of the body is maintained by the heat-regulating function of the skin. Heat is lost from the skin by radiation, conduction, and evaporation, which are dependent on the state of dilatation of the cutaneous bloodvessels and the activity of the sweat glands.

4. *Respiration.*—The respiratory function of the skin—namely, its power of exhaling water and carbonic acid and inhaling oxygen—is similar to that of the lungs, but is insignificant in comparison and is of minor importance.

5. *Sensation.*—The sensory function of the skin may be impaired—*i.e.*, all sense of feeling in the skin may be lost—from injury to a nerve supplying an area of skin, from destruction of a nerve, or from some general disease in which nerves are involved, such as leprosy.

The area of skin which is insensible in consequence may receive severe injuries, from burns, for example, without the patient being aware of it, while the burn is taking place.

6. *Absorption.*—So long as the skin is healthy and the horny layer of the epidermis is intact, its capacity for absorption is very slight, and absorption only takes place at the orifices of the hair follicles and at the sweat pores.

### Consequences of Accidents.

Accidents to the skin may arise from various sources. It is not proposed to deal with the grosser injuries of the skin, which are fully dealt with under the head of Wounds by Mr. Bucknall.

The accidents to the skin here discussed may be produced by—

1. Injury of the nature of small scratches, abrasions, scrapings, which by becoming infected may result in ulcers, boils, etc.
2. Irritants of animal, vegetable, or mineral origin, including drugs and the different causes of trade eruption. (See Occupation Diseases.)
3. Disease produced by inoculation with a virus or microbe.
4. Disease or inflammation produced artificially by the malingerer. (See Malingering.)

- |          |   |  |
|----------|---|--|
| 5. Heat. | } | As the results of injuries from heat and cold upon the skin may be associated with severe effects upon the constitution, they are dealt with under the separate heads of Heat, Cold, X Rays and Electricity. |
| 6. Cold. |   |  |

In the great majority of these accidents the visible effect on the skin is the production of a cutaneous inflammation, or dermatitis.

The inflammation may be localized, as in the case of a slight burn, or it may spread far beyond the area of application of the irritant, and become more or less generalized.

The majority of skin injuries require little or no consideration from the legal standpoint, as they heal so rapidly without after-

effects; but there are two groups of accidents which require special consideration both as regards their immediate effects and their consequences. These are (1) certain injuries arising from irritants of vegetable or animal origin, and (2) the occupation diseases. They are to some extent made accidents within the Workmen's Compensation Act, 1906, though they would probably not be so held at Common Law. The effects of heat and cold (burns and frost-bites) are dealt with in separate articles in this work.

The most important effects of the accident may be the production of local diseases:

- (i.) Boils or furuncles.
- (ii.) Impetigo.
- (iii.) Barber's itch.
  - (a) True sycosis, or inflammation of the hair follicles.
  - (b) Ringworm of the beard. (See below, iv.)
- (iv.) Ringworm; ringworm of the beard.
- (v.) Eczematous ulceration of the skin.
- (vi.) Tuberculosis of the skin.
- (vii.) Erysipeloid.
- (viii.) Cheloid (changes in the skin).

Of these, boils, impetigo, and sycosis of the beard—the variety of barber's itch due to microbes (*pus cocci*)—are the result of matter-producing microbes which either gain entrance through an abrasion of the surface or by the hair follicle.

(i.) **Boils.**—Furuncles or boils are the result of the presence of certain microbes (*pus cocci*) in the hair follicles and sebaceous glands, where they produce a deep-seated localized inflammation resulting in the formation of pus. Boils are specially common among men working in petroleum, tar, and paraffin, and in occupations in which the skin is kept moist from perspiration, from working in an overheated atmosphere, and is at the same time subjected to the action of dirt and various chemical irritants.

(ii.) **Impetigo.**—Impetigo is the name given to a contagious inflammation of the skin associated with the presence of pustules and crusts, and due to the inoculation of *pus cocci*. It is an extremely common disease, especially in children, and its contagiousity is great. The affection generally appears in the exposed parts, and is commonest on the face. This disease,

though disfiguring, is of minor importance, and does not impair the general health of the patient.

(iii.) **Barber's Itch.**—A form of sycosis of the beard, or barber's itch, may be caused by microbes (pus cocci) gaining entrance to, and growing in, the sebaceous material of the hair follicles of the beard and moustache. There they set up a chronic inflammatory process of a most intractable type. The affection may result from a scratch or cut with an infected razor, but this is by no means the only manner of infection, and any pus inoculation of the beard region may develop into it. It not infrequently occurs in the upper lip as the result of a chronic nasal catarrh and discharge. It does not affect the general health, though it may produce a certain amount of burning and itching and disfiguration.

(iv.) **Ringworm.**—Ringworm is due to a mould fungus, of which there are a number of varieties, which produce different types of the disease. It affects not only man, but a large number of the lower animals, from which it may be communicated to man. It occurs more commonly in children than in adults, and may be present on any part of the skin; but the most usual sites are the scalp, especially in children, and the skin of the exposed parts—namely, the hands, arms and face, and the beard region. In tropical countries it frequently occurs in the fork of the legs, when it is known as "dhubie itch."

It is only on the smooth skin that it appears in the form of rings, and there it does so only in certain cases; in others it takes the form of more or less round scaly spots which tend to coalesce into irregular patches, or it appears as raised, angry-looking sores. On the scalp it forms scaly patches covered with broken hairs which persist as short opaque stumps.

(v.) **Eczematous Ulceration of the Skin.**—Ulceration of the skin may occur as a complication of eczema or a moist "weeping" dermatitis due to different local irritants, such as dust, irritating liquids, etc. The ulceration is the result of inoculation of the inflamed skin with matter-producing microbes. It readily occurs in those whose health is impaired by disease, alcoholism, etc.

(vi.) **Tuberculosis of the Skin.**—When the tubercle bacillus is locally inoculated through an injury to the skin, one of the forms of tuberculosis of the skin may be produced. One of the most common types of tuberculosis of the skin is that known as "lupus vulgaris," which is characterized by the presence of soft reddish-brown nodules which coalesce to form

infiltrated patches, which tend to become ulcerated. Not infrequently, when the inoculation takes place about the hand, an indolent warty patch is the result, which from its prevalence among anatomists is known as "post-mortem" wart.

Tuberculosis of the skin is most liable to occur in those who live in close proximity to cases of phthisis and other forms of internal tuberculosis, or are themselves affected with the disease. The warty type is sometimes met with in slaughter-house men as the result of an abrasion of the skin received in cutting up a tuberculous carcass. The inoculation may take place in a great variety of ways. For example, a hospital nurse carrying a porcelain spittoon containing expectoration from a phthisical patient slipped and fell on the floor, breaking the spittoon. A piece of the broken vessel scratched her hand. A sore formed, which healed slowly and developed into a patch of tuberculosis of the skin. (For general tuberculosis, see below, Disease.)

(vii.) **Erysipeloid.**—In addition to ordinary erysipelas, there is a milder type of cutaneous inflammation which somewhat resembles it, and is known as "erysipeloid." This occurs most commonly upon the hands of butchers, fishmongers, cooks, etc., in the form of a dull red patch, which is slightly elevated and tends to spread, the part first affected clearing up. It spreads slowly, and usually remains limited to a small area, such as a finger. It differs from erysipelas in the absence of constitutional symptoms, in its milder course, and in the fact that the microbe which causes it is not known. Like erysipelas, it follows an inoculation through a scratch or abrasion. A number of cases have been recorded where the affection has followed crab-bites.

(viii.) **Cheloid, or Keloid.**—Cheloid (changes in the scar) is a fibrous new growth of the skin which may follow slight abrasions and injuries. It appears first as a small pinkish nodule, which grows so slowly that it may be weeks or months before much notice is taken of it. It gradually increases until it becomes a sharply defined tumour. The surface of the cheloid is smooth and usually hairless, and small bloodvessels may be seen ramifying over it. As a rule it is painless, but occasionally it may be tender, itchy, or even very painful. A number of cheloids are generally present. They may occur almost anywhere on the skin, but a common site for them is the front of the chest.

The causation of cheloid is at present unknown. There



seems to be a predisposition to it in certain individuals, but the exciting cause has not yet been discovered. Certain observers maintain that cheloids are caused by a specific microbe. Two types of cheloids are generally distinguished—namely, (1) cicatricial or false cheloids, which have their origin in an injury, such as a scratch, cut, or burn, or in the scars of certain skin lesions, such as those of acne and small-pox; and (2) spontaneous or true cheloids, which are believed to develop from the normal skin.

This distinction is not admitted by certain observers, who maintain that some abrasion or pre-existing defect of the skin invariably occurs and is essential for the development of the cheloid. In a few rare instances, where vaccination has been slow in healing, hypertrophic scarring and cheloid have been known to occur on the vaccinated areas. This may be the result of an idiosyncrasy in the individual vaccinated, or be caused by the simultaneous or subsequent inoculation of some other virus in addition to the vaccine.

### Disease.

1. **General Diseases resulting from the Accident.**—Various general diseases affecting the entire body may be produced by the accident. It is much more difficult, however, to prove that the infection leading to a general disease was introduced by the accident than in the case of local diseases, and it may be impossible to do so. As a rule, the general disease does not manifest itself till some time after the accident, the interval of time between the inoculation of the microbe of the disease and the appearance of well-defined symptoms being known as the “incubation period.” It is the period during which the microbes are multiplying themselves and their poisonous excreta or products sufficiently to produce changes in the body which manifest themselves as the “symptoms” of the disease.

The following is a list of some of the diseases which may be inoculated at the time of the accident :

- (i.) Syphilis.
- (ii.) Anthrax.
- (iii.) Glanders.
- (iv.) Tetanus.
- (v.) Erysipelas.
- (vi.) Blood-poisoning (septicæmia).
- (vii.) Vaccinia.

- (viii.) Tuberculosis.
- (ix.) Psoriasis.
- (x.) General eczema.

1. **Syphilis.**—One of the most serious results of the accidental abrasion of the skin is that it may permit of the entrance of the virus of syphilis. To illustrate the ease with which the disease may be implanted by slight abrasions, I may cite an instance:

A tattooer at a travelling show suffering from active syphilis tattooed as follows: He had his designs on transfer paper, which he moistened with saliva and stuck on the skin, and then pricked on the design. Four young men thus tattooed developed syphilis, with the primary sore on the marks, as the result.

Syphilis has been known to have been inoculated at the same time as vaccination. Such inoculation not infrequently occurred in the olden days of vaccination from child to child, but it rarely happens now, owing to the use of fresh glycerined calf lymph and the more perfect technique observed in the vaccination.

(ii.) **Anthrax.** (iii.) **Glanders.** (iv.) **Tetanus.** (v.) **Erysipelas.**—Each of these is dealt with in a separate article under the head of Anthrax, Glanders, Tetanus, and Infection (Erysipelas).

(vi.) **Septicæmia, or Blood-Poisoning.**—Abrasions and excoriations received by slaughter-house men in the cutting up of diseased carcasses may allow the entrance of bacterial poison, and the production of fatal blood-poisoning (septicæmia). The general blood-poisonings are all dealt with separately under the head of Infections (Septicæmia, etc.).

(vii.) **Vaccinia.**—There are three manifestations which occur in consequence of vaccination:

- (a) The local scarifications and consequent inflammation.
- (b) The general inoculation of the entire body with the vaccinia toxine, which confers upon it a greater or less immunity against the much more powerful virus of smallpox.
- (c) The rare general rashes which may follow the vaccination.

The first two need no detailed discussion here. In connection with the local inoculation of the vaccinia, cheloid has been known to occur in the scar, and the simultaneous inoculation of various inoculable diseases, such as syphilis and tuberculosis

(see above, Cheloid), have been recorded. (For these, see Syphilis and Tuberculosis.)

The use of glycerined lymph has removed the risk of the last two.

*The General Eruptions after Vaccination; Vaccination Eruptions or Accidents in the Course of Vaccination.*—Vaccination has from time to time been held to be responsible for causing various forms of skin disease, and been regarded as the point of infection of several general diseases. These dangers of vaccination have been grossly exaggerated by the anti-vaccination faddist, and are rare complications which result from idiosyncrasy on the part of the patient, carelessness on the part of the vaccinator or of those who had charge of the patient while the vaccination was healing, or are due to the employment of bad lymph. To show that idiosyncrasy on the part of the individual is an important factor in this connection is the fact that a generalized eruption may be associated with vaccination in one case only out of a group of cases which have been vaccinated with the same glycerined calf lymph. Of course the operation of vaccination abrades and wounds the tissue, and any inoculable microbe which happens to be present on the skin of the neighbourhood may gain entrance; and the same occurs, unless proper care be exercised, during the time the vaccination is healing. Both these accidents are due to want of sufficient care, and need not occur. There are general eruptions, however, of a different type, which may appear during the first three days after the vaccination, or more frequently occur later and follow the maturing of the pox, which are believed to be due to the absorption of the virus of vaccinia. These eruptions vary considerably; they may be scarlatiniform in type, may resemble measles, or they may be vesicular, bullous, or present lesions similar to vaccination lesions.

(viii.) **Tuberculosis** (as a General Disease arising after Injury to the Skin).—General tuberculosis is not liable to occur as a result of the inoculation of the tubercle bacillus through the skin. Should such inoculation take place, a patch of tuberculosis of the skin, generally of the type of lupus vulgaris, will result. General tuberculosis is much more likely to follow the entrance of the bacilli through the respiratory or the alimentary tracts.

(ix.) **Psoriasis**.—Psoriasis has not definitely been proven to have arisen from accident. Workmen have been known, however, to bring actions claiming that it arose in consequence of an abrasion on the legs. Psoriasis is a disease which, once

established, has a tendency to recur seasonally—in spring and autumn.

Vaccination has from time to time been blamed for causing psoriasis. A few cases of psoriasis have certainly been observed which appeared to develop from the vaccination, but there was not sufficient evidence that the vaccination caused the psoriasis, and it might equally fairly be said that the association of the psoriasis with the vaccination was a coincidence.

(x.) **Eczema.**—This has repeatedly been claimed to have developed from an accident. It has been added to the schedule of the Workmen's Compensation Act, 1906, when caused by caustic alkalis. Vaccination has been blamed frequently for producing it. An important point to be remembered is that occasional cases of so-called "eczema" are really congenital syphilis, which the doctor does not care to describe to the parents, particularly not to the mother; and the father, to hide his responsibility, may attribute it to vaccination. Congenital syphilitic eruptions frequently occur about the sixth week, and it is about that time that many children are vaccinated.

With regard to the relation of vaccination and eczema, the case is much the same as in psoriasis. Eczema on rare occasions may possibly arise from the vaccination lesions, but it may equally or more readily take origin from some other form of dermatitis. In the case of infantile eczema, where the association with vaccination can be so well studied, out of a large number of cases which I have observed, I do not remember one in which I was convinced that the vaccination had caused the eczema, and in the great majority of cases the eczematous eruptions preceded the vaccination.

2. **Existing before the Accident and aggravating its Effects.**—Any weakened condition of the body which reduces the vitality of the entire body lowers the local resistance, and increases the harmful effects of injury to the skin. Most skin abrasions and scratches heal readily. Should, however, the vitality of the part be defective from disease, an abrasion may lead to the formation of a chronic sore.

In connection with all the infective processes of the type of erysipelas, furuncles, etc., the liability to infection is increased, and the prognosis is modified for the worse if the patient be in an enfeebled state of health from some general disease or debilitating habit, such as alcoholism, diabetes, Bright's disease, rheumatism, an unhealthy environment, or other depressing circumstances.

**Spinal Injury.**—If the nutrition of a part be impaired by the nerve or part of the spinal cord supplying it being unhealthy (degenerate), as after an injury to the spine, or from disease involving the nervous system, such as locomotor ataxy, the part loses its vitality and power of resistance, and even slight injuries to it may be followed by serious results. In such cases an abrasion may lead to deep ulcers, known as “perforating ulcers,” and to bedsores, which heal with the greatest difficulty, and may even necessitate the amputation of the affected part.

**Varicose Veins.**—When varicose veins occur in the legs, especially if they be associated with dropsy, and a defective power of resistance of the skin is present, a slight abrasion of the leg may result in a painful ulcer, which may interfere with work, and to heal which it may be necessary to rest with the leg up for a month or longer.

**Old Skin Diseases aggravated or accentuated by Accident.**—Any skin disease already in existence may be made worse by injury. A quiescent tubercular condition of the skin which is irritated by a blow, scratch, or abrasion, may awake into activity, whereas without the injury it might have remained comparatively quiescent. Some occupations are particularly liable to irritate and make a skin disease worse; the result may be a claim against an employer for a new disease caused by accident, when in reality it is not new, but an old disease made worse by the man’s occupation.

### Operation.

An operation is only called for in certain skin diseases. The hard scar, called “cheloid,” has often been excised with doubtful results, and operative measures are liable to do more harm than good, as the cheloid tends to recur in the scar after excision or destruction by the cautery.

Simple skin cuts may require a stitch to close up the wound.

Syphilitic primary sores also have been excised, but this does not appear to delay the secondary symptoms.

Tuberculosis of the skin has been scraped, excised, and burned, with excellent results. In cancer of chimney-sweeps and petroleum-workers, where suspicious warty growths or cancer have developed, immediate and thorough removal by operation is demanded. When operation is performed early, the chances of recovery without recurrence are fairly good. When the cancerous process has extended widely and deeply, and metastatic growths have developed in the neighbouring glands, operative

treatment may be powerless to prevent a fatal issue. The cancer is, fortunately, not of the most malignant type, and there is fair hope of recovery if the cancerous growth be removed early.

For the operations called for after heat or cold, see Heat and Cold respectively, and for those connected with varicose ulcers, see Vessels.

Large bare areas denuded of skin may require skin-grafts. These may be taken from a living person or from a recently amputated limb.

### Cure.

(a) **Local Diseases.**—Simple abrasions may heal readily, and if not infected may be well in a few days; but if a septic infection takes place and matter be formed, or if the virus of some disease be inoculated, then healing may be prolonged indefinitely.

**Anthrax.**—See Anthrax.

**Barber's Itch** is a curable affection, but most resistant to treatment, and it is unwise to express a firm opinion as to the time it may take to eradicate it.

**Blood-Poisoning.**—See Infection, Septicæmia, etc.

**Boils** heal readily with appropriate treatment, though they tend to come out in crops, which delays healing for months in spite of careful treatment.

**Cheloid.**—See Keloid.

**Drug Eruptions.**—One of the most important of the drug eruptions in this connection is that caused by arsenic. The typical eruption is a dry, scaly, pigmented condition of the skin associated with itchings and the formation of warty thickenings, which have been known to develop into cancer. In addition to this, urticarial, bullous and gangrenous eruptions have been observed, and there are numerous instances where herpes zoster or shingles has followed the administration of the drug. These eruptions gradually fade when the medicine containing the drug is stopped. In the case of the more extensive and infiltrated rashes from other drugs, such as those of bromide, it may be some weeks before they disappear.

**Eczematous Ulceration of the Skin.**—The presence of ulceration in association with eczema greatly interferes with the curing of the disease, and may render it necessary for the patient to rest for several weeks or longer to insure healing.

**Eczema.**—Some cases of eczema are rapidly amenable to

suitable treatment, and are definitely curable; others, again, have a marked tendency to recur. The time required for the cure of an attack varies from a few weeks to several months.

**Erysipelas.**—See Infection—Erysipelas.

**Erysipeloid.**—This is amenable to local treatment, and tends to disappear spontaneously.

**Glanders.**—See Glanders.

**Impetigo** is curable in ten days to a fortnight.

**Keloids.**—Keloids or cheloids run a chronic course, and may last through life. Occasionally they tend to disappear spontaneously. Treatment as a rule gives disappointing results, and operative measures may do more harm than good, as the cheloid tends to recur in the scar after excision or destruction by the cautery.

**Psoriasis.**—An individual attack of psoriasis is, under favourable conditions for treatment, as a rule curable in from a month to six weeks. There are cases, however, in which the disease seems to resist treatment for a much longer period. It is the general rule for psoriasis to recur, and the recurrences are frequently periodic—*i.e.*, coming on in the spring or autumn of several successive years. At other times a fresh outbreak may be determined by some general disturbance of health, some mental worry or anxiety, or possibly from injury. In a patient suffering from an attack of psoriasis, fresh patches are liable to occur in the sites of pressure, friction, and injury.

It is doubtful whether an injury can be held responsible for producing psoriasis *de novo*, though cases have occurred in which an injury has been followed so closely by an attack of it as to suggest a causal connection between the two; but until the cause of psoriasis is known it is impossible to decide whether such cases are *propter hoc* or simply *post hoc*.

**Ringworm.**—1. Ringworm of the beard and head: The successful treatment is difficult and tedious, and it may take several months to cure.

2. Ringworm of the skin, apart from the beard or head, is a much simpler disease to get rid of, and should be cured, if thoroughly treated, in about three or four weeks.

(b) **General Infections of the Body through Skin Wounds.**

—**Septicæmia.**—See Infection—Septicæmia.

**Syphilis.**—The cure of syphilis necessitates three to four years under more or less continuous treatment and supervision, and late symptoms may develop which prolong the cure indefinitely.

**Tetanus.**—See Tetanus.

**Trade Eczemas.**—In the case of all the forms of “trade eczemas,” once the dermatitis is established it is essential, for the successful treatment of it, that all exposure to the irritant should be avoided till the dermatitis has healed and the skin has recovered its normal tone. This may mean rest from work for a month or longer, according to the extent and severity of the attack. The time for cure varies from a few days to a month or six weeks. During that time it is imperative that the patient should not expose himself to the action of the irritant which caused the dermatitis, and this may mean his having to give up his work during that time.

**Tuberculosis.**—Tuberculosis of the skin is always a chronic affection. In localized cases the diseased skin may be excised or destroyed by cauterization or scraped away. Where the disease is extensive, it is difficult or impossible to completely eradicate it, and a recurrence is to be expected. By means of the Finsen light it is possible to thoroughly destroy the disease with the production of far less scarring than by the older surgical methods, but this treatment takes months or years to carry out, according to the extent of the diseased area, and is only called for in the case of the face, where it is important to minimize scarring.

**Ulcers.**—Ulcers are invariably difficult to heal, and if they occur on the legs it is usually necessary for the patient to lie up for about a month to insure healing.

**Vaccinia Eruptions** are readily amenable to treatment, and are usually curable in a week or ten days.

### Return to Work.

**Anthrax.**—See Anthrax.

**Barber's Itch** need not prevent a man following his usual work, except on account of the disfigurement it may cause (*e.g.*, in a waiter).

**Blood-Poisoning.**—See Infection—Septicæmia.

**Boils**, if in large crops, may keep coming out for months, and may cause excessive discomfort; the general health may be impaired, and work may be interfered with.

**Cheloid.**—See Keloid.

**Eczema.**—An attack of eczema may prevent a man from continuing his work for a few weeks or longer, according to the extent and severity of the attack, as it is imperative that while



the attack lasts the patient should not expose himself to the action of the irritant which caused the eczema.

**Eczematous Ulceration of the Skin.**—An eczematous ulceration can rarely be cured under a month or six weeks.

**Erysipeloid**, occurring most commonly on the hand, need not materially interfere with the occupation.

**Erysipelas.**—See Infection—Erysipelas.

**Glanders.**—See Glanders.

**Keloid** rarely interferes with work.

**Impetigo** when on the face is disfiguring; but it does not affect the general health, and need not interfere with the work, except in the case of a waiter or other such employment.

**Psoriasis.**—A mild attack of psoriasis does not prevent the patient working; but for the efficient treatment of a severe generalized attack it may be advisable to confine him to bed, and he may be unable to continue his work for a month or six weeks.

**Ringworm of the Beard.**—See Barber's Itch. It is a purely local affection, and does not interfere with the general health or work of the patient.

**Septicæmia.**—See Infection—Septicæmia.

**Syphilis.**—In mild cases little or no interference with the work of the patient may be caused. On the other hand, in cases where severe symptoms occur, work may be rendered impossible for several months or longer, during which period it may even be advisable for the patient to lie up. The skin eruptions of the secondary period of the disease, especially when the face and hands are markedly affected, may from æsthetic reasons interfere with the employment of the patient; or where ulcerations have formed and running sores are present, such cases being dangerously contagious, the occupation of the patient may be seriously interfered with; and even if he were able to work, it may be inadvisable to permit him to do so till he ceases to be a source of danger to others.

There is another aspect of syphilis which may temporarily diminish the capacity of work of the patient, and that is the mental influence: for in many cases an attack of syphilis and the prolonged treatment with mercury which it entails have a markedly depressant effect on the patient, which may render him for a time unfit to carry on satisfactorily an occupation involving intellectual concentration or mental strain. Years after an attack of syphilis seems to have been recovered from late lesions may develop in the skin, in the form of ulcers, in

the internal organs in the form of tumours, and in the nervous system, which may materially affect the general health of the patient, and may render him incapable of working.

**Tetanus.**—See Tetanus.

**Trade Eczemas.**—See Eczema.

**Tuberculosis of the Skin** may not interfere with the work of the patient. On the other hand, if extensive and affecting the face, the disfigurement caused by it may render certain work impossible. Tuberculosis of the skin may be associated with underlying bone disease, etc., which may seriously interfere with work.

**Ulcers** may prevent a man from returning to work; for example, if he has one on his leg, it may be necessary for him to rest the leg up for several days, or even weeks, to effect a cure.

**Vaccinia Rashes**, unless severe, need not necessarily interfere with the work.

### Recurrence and Sequelæ.

Most forms of skin disease which result from accident show no tendency to recur. Various skin diseases—psoriasis, for example—have a tendency to recur at regular periods, as, for instance, spring and autumn. As a rule the inflammatory disturbances of the skin are curable by treatment, and most forms of dermatitis rapidly disappear when the source of the irritation is removed and suitable treatment is employed. On the other hand, dermatitis may be succeeded by an excessive degree of vulnerability of the skin, so that it is rendered prone to react in a harmful fashion to numerous irritants, both external and internal—*i.e.*, reaching the skin via the blood-stream—which are of so mild a character that they would have had no deleterious effect on the skin had it not been rendered abnormally sensitive by the previous dermatitis. As a concrete example of this, I recall a case which was recently under my care at Charing Cross Hospital, in which a gardener, as the result of handling the *Primula obconica* a couple of years ago, became afflicted with an inflammation of the skin of the arms and hands, the parts in actual contact with the plant. This dermatitis was of the nature of an acute weeping eczema. Under local treatment it gradually healed, and the patient was warned of the danger of touching poisonous plants, and of exposing himself to well-known sources of irritation of the skin. This he has avoided as carefully as was compatible with his work; but in spite of

his care he is now subject to eczematous outbreaks on the slightest provocation, and to generalized attacks of ordinary eczema, apart from any apparent external cause. In short, ever since his dermatitis from the primula he has been a martyr to eczema.

As was already stated, such a degree of susceptibility to the special irritant and other forms of cutaneous irritants may be set up that it may be necessary for the patient to change his work to some other occupation, in which his skin is not likely to be irritated. In some cases the dermatitis is followed by so great an increase in the susceptibility of the individual towards the irritant or allied irritants, a susceptibility which may persist for years or be permanent, that he is unable to expose himself to it without the dermatitis recurring, in which case he may have to give up his special work.

In a few cases the localized dermatitis is followed by a tendency to attacks of generalized eczema, as in the case of the gardener referred to above, or it may be succeeded by the still more serious sequelæ of cancerous growth of the skin, as in the type of cancer caused by the local irritation of soot, and known as "chimney-sweep's cancer."

#### Occupation Diseases and Occupations in which Special Skin Diseases occur.

Under this head are included—

- (i.) Trade eczemas.
- (ii.) Skin irritations produced by drugs used medicinally or otherwise upon the surface of the skin.
- (iii.) Skin eruptions caused by the ingestion of drugs into the stomach.
- (iv.) Microbic infection.

Although at first sight these skin irritations appear clearly separable, yet at the same time there is no logical difference between them. A man may be working in arsenic, may be handling arsenical wall-papers, or take it medicinally under the advice of a properly qualified medical man, and in each case he may have an arsenical skin eruption. In consequence, in this section the various irritants, apart from microbes, which are capable of producing an inflammation of the skin, are classed together independently of how they reach the skin.

The fourth class of occupation diseases of the skin is caused by microbes, such as anthrax, glanders, etc. These have been

already dealt with elsewhere or above, but will also be classified below in reference to the particular trade in which the illness is likely to be caused.

Under this head of Occupation Diseases, therefore, will be considered the various forms of dermatitis produced by the local irritation of a large number of irritating substances of animal, vegetable, and mineral origin. It includes, as has been said, the important group "occupation diseases" or "trade eczemas." In a work of this description it will be impossible to give anything approaching a complete list of these substances, as their number is legion, and only the most common and best-known of them will be referred to.

A certain number of these substances are capable of causing a dermatitis in any skin, such as, for example, croton oil or cantharides; while perhaps, in the majority of instances, the irritant can only do so if the individual affected has idiosyncrasy towards it. For example, half a dozen men may be working together in the same bakehouse at the same time, and only one of them become affected with "baker's itch"; or the same number of women may be employed in a washing-house and have their hands and arms constantly immersed in hot water with soda in it, and only one of them will develop a dermatitis from the alkali. This susceptibility may be a natural peculiarity of the individual, owing to his having a delicate skin: it may be due to a congenital defect of the skin, such as mild ichthyosis; or it may be acquired, owing to the resistance of the skin being diminished as the result of some general illness, or from the pre-existence of some skin affection, such as eczema or psoriasis.

The dermatitis, which is generally eczematous in type, and varies, according to the virulence of the irritant and the individual susceptibility, from a simple erythema to a vesicular, bullous, or pustular inflammation, is usually curable, provided the cause be removed and suitable treatment be adopted.

In this connection, as has been said, it is immaterial how the drug is given, whether it be by the mouth, by injection, by inhalation, or *per rectum*. Eruptions produced by drugs are fortunately rare. They may result from idiosyncrasy on the part of the patient, overdosage, too long continuance of the drug, or disease of the heart or kidneys, interfering with the elimination of the drug.

A large number of drugs are capable of producing a dermatitis, and even a small dose of them may cause it in a susceptible

individual. Only three of these produce eruptions which are peculiar and generally recognizable; these are the bromides, iodides, and arsenic. The others cause various forms of dermatitis, such as erythematous blotches, wheals, rashes, simulating of measles or scarlet fever, vesicular, bullous, pustular, or gangrenous eruptions, according to the individual susceptibility of the patient to the drug.

The following are the chief groups of irritants to the skin, and their effects. In the next section is given a list of the principal trades which suffer.

The action of some of these irritants is purely local, while in the cases of others the effect spreads far beyond the site of application.

(A) *Drugs, etc., which produce Skin Disease.*

**Amido-Benzines.**—Amido-benzines and the benzines may set up an erythematous or urticarial eruption. (See Poisons—Nitro and Amido Benzines, p. 636.)

**Aniline.**—From using aniline dyes, especially black and red dyes, dyers are frequently affected with an eczematous inflammation of the skin. Aurantia, an orange-yellow dye used in colouring cheap yellow shoes, is a well-known irritant. Not only may the dyers be affected, but the wearers of the dyed articles may suffer from irritation, and cases of dermatitis caused by the dye from such dyed articles of apparel as socks, gloves, flannel shirts, and drawers, are not uncommon. (See Poisons—Nitro and Amido Benzines, p. 636.)

**Anthracene.**—See Coal-Tar.

**Antifibrin.**—In predisposed individuals, or where large doses have been employed or the drug long continued, a peculiar cyanotic (slaty-blue coloured) condition is produced in the skin, due to an alteration in the blood.

**Antipyrin.**—Various types of eruption are produced by antipyrin. Of these, the most common is an erythematous one, followed by pigmentation, the backs of the hands being specially liable to be involved. Occasionally vesicular or bullous eruptions may appear.

**Antitoxine.**—The eruption produced by antitoxine are erythematous in type, and frequently resemble the rashes of scarlet fever and measles. Sometimes they are urticarial in character. The rashes are not distinctive, and only occur in certain individuals. They do not itch, but are frequently followed by desquamation.

**Arnica**, when rubbed in for bruises or sprains, is apt to cause a papulo-vesicular dermatitis, associated with much irritation.

**Arsenic**.—The typical arsenical eruption is a dry, scaly, brown condition of the skin, associated with itchings and the formation of warty thickenings, which have been known to develop into cancer. In addition to this, other forms of eruptions have been observed—wheals, blebs, blisters, and even gangrene of the skin. There are numerous instances where shingles (*herpes zoster*), a collection of little clear blebs on a slightly red skin, frequently occurring in the skin over the ribs, have followed the administration of arsenic. (See Poisons—Arsenic, p. 621.)

**Arsenic Sulphide**.—Furriers occasionally get a severe dermatitis with persistent ulceration from sulphide of arsenic and lime used in preparing fur. (For general effects of arsenic, see Poisons—Arsenic, p. 621.)

**Benzene**.—See Coal-Tar; Poisons—Nitro and Amido Benzenes.

**Bromide**.—The bromide rash is, as a rule, pustular, and the most prevalent type is an eruption of discrete elevations dotted over with minute pustular points, and covered eventually with dirty yellow scabs. These elevations vary in size from a split pea to large lesions several inches in diameter.

**Cantharides**.—Spanish fly—a drug which produces blisters.

**Capsicum**.—Capsicum occasionally causes an erythematous or vesicular rash.

**Cement**.—See Lime.

**Chlorate of Potash** may cause a papular eruption, or sometimes a general cyanosis (slaty-blue colour).

**Chloral Hydrate** may cause various eruptions, mostly of an erythematous type.

**Chlorine**.—Chlorine workers suffer from a severe type of acne, which results from the action of vapours of chlorine which are given off in the manufacture of it by the electrolysis of the chloride of sodium and potassium.

**Chrome**.—Chrome may cause ulceration of the nose, or its sequelæ. (See Poisons—Chromium, p. 627.)

**Chromic Acid**.—Bichromate of potassium tends to produce ulcers in those who use it in their work, such as French polishers, etc. (See Poisons—Chromium, p. 627; and also Nose, p. 594.)

**Chrysanthemum**.—See Plants.

**Chrysarobin**, a drug extensively used for the cure of psoriasis, tends to cause a deep red erythema, and occasionally a universal exfoliative dermatitis. It causes much irritation and a severe conjunctivitis if it reaches the eye.

**Coal-Tar.**—Workers with coal-tar and pitch are very liable to suffer from a form of dermatitis known as “tar-acne” or “pitch-skin.” There are various grades of this affection. In mild cases it may exist simply as a brownish discoloration of the skin of the exposed parts, such as the forearms and face, associated at times with a yellowish discoloration of the whites of the eyes. More usually, however, the most marked feature is the presence of innumerable “black-heads,” situated chiefly on the face, neck, back, chest, and arms, many of which have become infected with matter-producing microbes, and transformed into acneiform pustules—the so-called tar-acne. This type of skin being constantly irritated by the tarry products is apt to assume a condition of chronic inflammation and weakened resistance, with the result that it becomes prone to eczematous changes, and is liable to become ulcerated. In addition to the pustules, warty growths are frequently present about the face, neck, scrotum, etc., and these are often associated with a marked thickening of the skin of the palms of the hands. As the result of further irritation of the warty growths by pitch-dust or tarry fumes, or from the action of some extraneous cause, such as injury or friction, the “tar-warts” are liable to increase in size, assume malignant characteristics, and become transformed into “epitheliomatous cancer.” (For the time for cure, see Eczema, Trade Eczemas, and Eczematous Irritation of the Skin, pp. 722, 724.)

**Copaiba.**—Several forms of eruption are caused by this drug; these are generally of an erythematous character, and chiefly affect the hands, arms, legs, and feet. Occasionally an urticarial, bullous eruption has been observed.

**Cowhage.**—See Plants.

**Cubebs** may produce a general papular, erythematous eruption lasting a few days, and followed by desquamation.

**Digitalis** occasionally produces a universal erythematous eruption, sometimes resembling scarlet fever. Desquamation of the skin, with shedding of hair and nails, has been reported as a result of it.

**Drugs.**—The handling of various drugs may cause eruptions on the hands of chemists.

**Dust.**—The local irritation of dust and dirt may cause an

inflammation of the skin. Should any abrasion be present in the skin, the dust may infect it, and cause suppuration, or even produce tetanus by conveying the microbes of that disease. Fine dust may act like soot (see Soot), and produce in time a warty dermatitis, with a tendency to become cancerous.

**Ergot** may cause various types of eruptions, which may be vesicular, bullous, pustular, or gangrenous in character. The eating of ergoted rye for long periods is more frequently the cause of eruption than the taking of the drug.

**Eucalyptus.**—See Plants.

**Flour and Sugar.**—Workers with flour and sugar—bakers, for example—are liable to suffer from a form of inflammation which affects chiefly the hands and forearms, which is called “baker’s itch.”

**Food Rashes.**—Various eruptions are produced as a result of the auto-intoxication from various food-stuffs, such as shell-fish, fish cooked in oil, pork, strawberries, etc. Certain food-stuffs are capable of producing eruptions in most individuals, while others only occur in a few susceptible persons. These eruptions vary in type, the most common varieties being urticarial, papular, or erythematous rashes, suggesting scarlet fever and measles.

In rare cases bullous or purpuric eruptions are produced. These rashes quickly disappear when the cause is eliminated from the system, and rarely last more than a few days. The urticarial type, however, may persist several weeks. (See Food Rashes.)

**Formalin.**—This causes a form of nettlerash (urticaria), or eczema, in those susceptible to its action.

**Glanders.**—See above, Glanders.

**Iodide.**—The taking of iodides internally, or the manufacture of iodide of potassium and other drugs containing iodine, cause a well-marked eruption, associated with other symptoms, such as running at the eyes, etc. The iodide eruption is, as a rule, pustular in character. The lesions are smaller than those caused by bromides. Raised lesions, like those of the bromide eruption, may occur, but they are rare. This eruption is not uncommon as the result of taking quack blood mixtures containing iodide of potassium. Other types of eruption may occur after both bromides and iodides, such as urticarial or vesicular rashes.

**Iodine.**—See Iodide.



**Iodoform.**—Iodoform is used in dressing wounds, and may cause a papulo-vesicular eruption extending beyond the area dressed with the drug.

**Ivy.**—See Plants.

**Lime.**—Builders are liable to inflammation of the skin of the exposed parts from working with lime, Portland cement, etc. Electroplaters employ a mixture of lime-dust and olive-oil in the finishing departments, and sour beer in the process known as "scratch brushing," and are liable to inflammation of the skin in consequence.

**Mercury.**—Mercury, when rubbed into the skin medicinally in an ointment, occasionally sets up an intense inflammation. Workers in mercury also suffer heavily from the poisonous effects of the drug. (See Poisons—Mercury, p. 634.)

**Metol.**—Metol, a drug extensively used in photography in developing, is capable of producing marked inflammation of the skin, which may become vesicular in character.

**Morphia.**—Sometimes after the ingestion or injection of morphia there results an erythematous eruption accompanied by great itching and pricking.

**Oleander.**—See Plants.

**Oysters.**—Oysters in some persons cause acute swelling of the skin, of the nature of nettle-rash.

**Paraffin.**—Paraffin workers, like chimney-sweeps, are subject to a warty dermatitis, sometimes of the arms and the hands, and commonly of the scrotum, which is liable to become cancer and produce fatal results. Among the irritating substances which are responsible for the malignant dermatitis are the oily matters of the shale. The prognosis in such cases is fairly good when early excision is practised.

**Phenacetin** occasionally produces a papular, erythematous eruption, chiefly affecting the hands.

**Phenyl Hydrazine**, a drug used in urine-testing, is capable of producing severe skin inflammation.

**Phosphoric Acid.**—This drug has been known to cause a bullous eruption, and phosphorus to produce purpura.

**Pitch.**—See Coal-Tar.

**Plants.**—There are over sixty or seventy plants which are capable of producing inflammation of the skin in susceptible individuals, varying from simple redness to swelling and the formation of bullæ; and of these the most common are the balm of Gilead, chrysanthemum, eucalyptus, poison ivy (*Rhus toxicodendron*), cowhage, oleander, rue, squill (*Primula obconica*).

**Poison Ivy.**—See Plants.

**Primula Obconica.**—See Plants.

**Quinine.**—Eruptions are rarely produced by quinine taken internally, though an eczematous rash not infrequently occurs in workmen in quinine factories from the local irritation of the drug.

The eruptions due to the internal administration vary considerably, some being erythematous, while others are urticarial or bullous.

**Rue.**—See Plants.

**Salicylic Acid** may produce an erythematous eruption like scarlet fever, and the lesions may be bullous or urticarial in character.

**Silver Nitrate.**—When silver nitrate is taken for a prolonged period, argyria, or slate-coloured pigmentation of the skin, is produced.

**Soot.**—Chimney-sweeps, from the irritation of the soot from hard or stone coal, are liable to a warty form of dermatitis which chiefly affects the scrotum.

These warts have a tendency in time to ulcerate, and eventually to become cancerous, and the not uncommon condition of “chimney-sweep’s cancer” may result. (See Genital Organs—Male, p. 397.)

**Squill.**—See Plants.

**Sulphonal** may cause erythematous or macular eruptions of a scarlatiniform type.

**Tar.**—See Coal-Tar.

**Turpentine.**—This may set up an inflammation like cantharides or mustard.

(B) *Occupations which produce Affections of the Skin.*

**Autotypers** [bichromate of potassium] may have to use bichromate of potassium, which sometimes causes intense inflammation of the skin, associated with destructive ulceration.

**Bakers** [baker’s itch—flour and sugar] frequently suffer from a skin affection caused by handling flour or sugar, which affects chiefly the hands and forearms, and is sometimes called “baker’s itch.”

**Builders** [cements and lime] are liable to an affection of the skin of exposed parts from working with lime, cement, etc.

**Carpenters** [dust of hard woods—teak, cocus-wood, etc.] may get a skin affection from the resinous dust of certain hard woods, like teak, cocus-wood, etc.,

**Chemists** [drugs on the skin] are apt to suffer from inflammation of the skin due to one or other of the irritants they have to expose themselves to in their work.

**Chimney-Sweeps**, from the irritation of the soot from hard or stone coal, are liable to a warty form of skin affection which chiefly involves the scrotum.

These warts have a tendency in time to ulcerate, and eventually become cancerous, and the not uncommon condition of "chimney-sweep's cancer" results. The cancer may persist for some time in the scrotum, or it may pass deeply and involve the testicles. After a longer or shorter period, the groin glands and the penis may become involved.

This affection is so prevalent that some years ago the Registrar-General estimated that chimney-sweeps were eight times more liable to die from cancer than men in general. Though this is possibly a larger proportion than obtains at the present time, it merits grave consideration, more especially as the number of cases could probably be reduced were measures of cleanliness more carefully practised, and clothes which afforded better protection worn by sweeps. The cancer is, fortunately, not of the most malignant type, and there is fair hope of recovery if the cancerous growth be removed early.

**Coal-Tar or Pitch-Workers** are liable to suffer from a form of chronic dermatitis (see Coal-Tar), which tends to go on to warty growths—the so-called "tar-warts"—and to end in "epitheliomatous cancer." The forearms, neck, and scrotum are the parts generally affected. It is due partly to the fine particles from the tar and pitch irritating the skin, and to the exposure of the skin to the fumes from the melted pitch and the distillation products of coal-tar, such as anthracene, creosote, and benzene. It frequently occurs in workmen in coke and anthracite works, and in manufactories of products of pressed coal, like "bricketts."

**Dyers** [aniline dyes], from using aniline dyes, especially black and red ones, are frequently affected with an eczematous dermatitis. Aurantia, an orange-yellow dye used in colouring cheap yellow shoes, is a well-known irritant. Not only may the dyers be affected, but the users of the dyed articles of apparel, such as socks, gloves, flannel shirts, drawers, veils, etc., may also suffer from the irritation.

**Electroplaters** [lime-dust and olive-oil mixed in finishing, sour beer in the "scratch brushing"] employ a mixture of lime-dust and olive-oil in the finishing department, and sour

beer in the process known as "scratch brushing," and in consequence are liable to skin affections.

**French Polishers** [bichromate of potassium].—Like autotypers (which see above), polishers are liable to suffer from dermatitis from using bichromate of potassium.

**Furriers** [sulphide of arsenic] occasionally get a severe skin affection, with persistent ulceration, from the sulphide of arsenic and lime used in preparing furs.

**Gardeners** [poisonous plants] are liable to attacks of skin inflammation from handling one or other of the numerous irritating plants. Only susceptible individuals are attacked.

**Joiners** [dust, especially resinous dust—teak, cocus-wood, etc.], like all workers in wood, are liable to suffer from skin affection caused by the resinous dust from certain hard woods, like teak, cocus-wood, etc.

**Ostlers** [glanders, horse ringworm, dog ringworm] and others who have much to do with animals, may become affected by glanders and animal ringworms.

**Paraffin Workers**, like chimney-sweeps, are subject to a warty skin affection, sometimes of the arms and hands, and commonly of the scrotum, which is liable to become cancer and produce fatal results. The majority of cases occur in the refiners of solid paraffin, while the shale-miners and retort-men are comparatively exempt.

The number of cases is said to be diminishing. Among the irritating substances which are responsible for the malignant dermatitis are the oily matters of the shale.

The prognosis is fairly good when early excision is practised.

**Skin Workers** are liable to contract anthrax from the hides they work among. (See Anthrax, p. 89.)

**Sweeps** ["chimney-sweep's cancer"].—See Soot.

### Diagnosis.

**Anthrax.**—See Anthrax.

**Blood-Poisoning.**—See Infection, pp. 436-454.

**Cheloid.**—It is necessary to distinguish cheloids from simple overgrown scars, which may occur where the skin has not united evenly, and redundant masses of fibrous tissue have formed at the cicatrix. In such cases the overgrowth is limited to the line of injury, while in cheloids it spreads beyond the scar.

**Eczema** is a disease of the skin characterized by the presence

of red spots surmounted by vesicles containing fluid, which tend to coalesce, to form weeping and crusted patches.

**Eczematous Ulceration of the Skin** may be recognized by the association of superficial ulcerations with eczema. (See Eczema.)

**Erysipelas.**—See Infection—Erysipelas, p. 443.

**Glanders.**—See Glanders, p. 407.

**Psoriasis.**—The characteristic eruption of psoriasis consists of bright red, variously sized, rounded, and sharply defined spots, covered with silvery scales, which, on being scratched off, reveal small bleeding-points. The most common sites for the eruption are the knees, elbows, and scalp, but it may be widely distributed over the whole skin.

**Ringworm.**—This is diagnosed by microscopic examination of the affected hair.

**Syphilis.**—The skin eruptions of syphilis may be characteristic, and most commonly consist of macules, papules, pustules, and, in the late stages, of superficial gummata and tubercles. Syphilis has a multiformity of eruptions associated with it, and may present the greatest difficulty in its diagnosis. It has been described as the great imitator of other skin diseases.

**Tetanus.**—See Tetanus, p. 787.

**Tuberculosis of the Skin.**—The most common type of tuberculosis of the skin is characterized by reddish-brown, soft nodules or patches, of slow growth, varying in size from a pin's head upwards, which tend to break down and ulcerate.

**Vaccinia.**—See Vaccinia, p. 718.

### Malingering.

**Feigned Eruptions (Dermatitis Artefacta).**—It is by no means an uncommon thing to see cases of eruptions or injuries of the skin which have been self-inflicted for purposes of deception. Such cases generally occur in hysterical women with the object of exciting sympathy or of avoiding work, but they may also occur for similar reasons in weaklings and malingerers of the male sex. The eruptions are varied as to the means which are employed for their production, and are frequently in the form of erythematous, bullous, or gangrenous patches. All manner of irritants, such as carbolic acid, vinegar, cantharides, and strong alkalies, may be responsible for them. I remember a case where an eruption of inflamed, superficially ulcerated round lesions was produced by applying a penny soaked in

vinegar, and another where peculiar erythematous blotches resulted from rubbing the skin with the finger moistened with saliva. The diagnosis of these eruptions may present considerable difficulty, but there is usually something about their shape, their sharply defined edges, general character, and distribution, which does not conform to any recognized form of skin disease, and will raise the suspicion that they are artificially produced. They almost invariably occur in situations which can easily be reached by the hands, and in the case of right-handed people they are as a rule confined to parts which can be got at by the right hand. The lesions make their appearance suddenly, and often during the night, or at such a time as the patient is alone and has an opportunity of producing them. If a fixed dressing, such as zinc gelatine, be applied to the lesions, they will quickly become healed, while new ones may appear beyond the dressing or in other situations. Another aid to the diagnosis is the general type of patient, for in so many cases there is marked neurosis, a furtive look on being questioned, and other suggestive signs of malingering.

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*For legal cases of injury to the Skin, see CASE GUIDE : Skin.*

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## SKULL.

*See* BRAIN, BONES, EAR, EYE, NOSE, TEETH, THROAT.

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## SNAKE BITE.

*See* TROPICS.

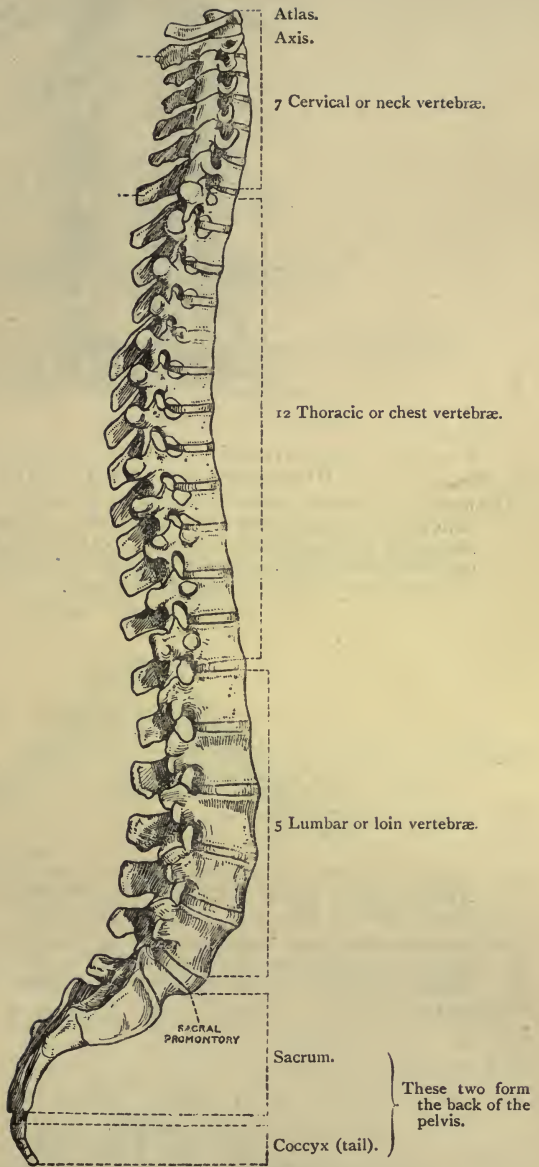


FIG. 165.—THE SPINAL COLUMN, SEEN FROM THE RIGHT SIDE.  
(From Buchanan's "Anatomy.")

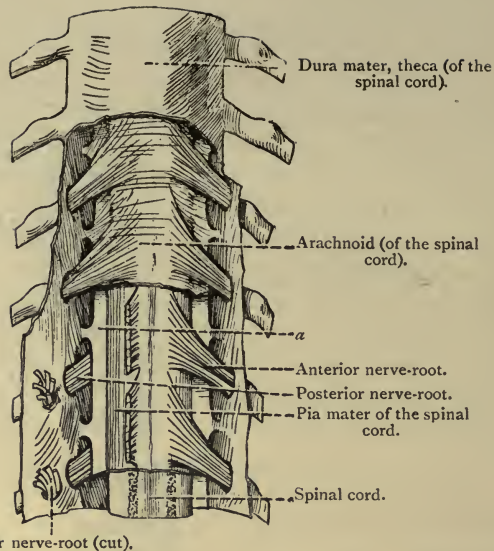


FIG. 166.—PART OF THE SPINAL CORD, PARTIALLY COVERED WITH ITS MEMBRANES, AND SEEN FROM THE FRONT.

The upper third is still covered with the dura mater, which is removed over the next third, displaying the arachnoid under the dura mater. The lower third shows the pia mater, and two nerve-roots on the right side are cut, showing the posterior nerve-roots behind. Just at the lowest border a small part of the spinal cord, bare of coverings, is shown.

(From Buchanan's "Anatomy.")

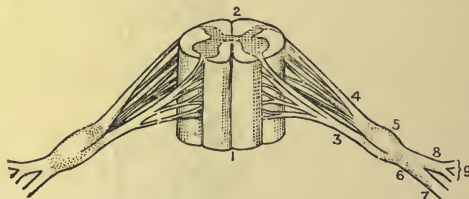


FIG. 167.—A PART OF THE SPINAL CORD, FROM WHICH ARE PASSING TWO NERVES, WITH THEIR ANTERIOR AND POSTERIOR ROOTS ON EACH SIDE. FRONT VIEW.

All the membranes have been removed. 1, The anterior median fissure; 2, the posterior median fissure; 3, anterior or motor nerve-root; 4, posterior or sensory nerve-root; 5, spinal ganglion; 6, spinal nerve; 7, 8, 9, divisions or nerves.

(From Buchanan's "Anatomy.")

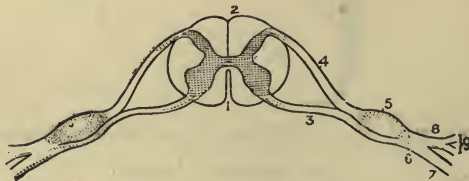


FIG. 168.—THE SAME SECTION OF THE SPINAL CORD, SEEN FROM THE FRONT AND ABOVE.

The numbers are the same as in Fig. 167.

(From Buchanan's "Anatomy.")



## SPINE.

By FREDERICK E. BATTEN,

M.D., F.R.C.P.,

Physician to the Hospital for Sick Children, Great Ormond Street ;  
Physician to Out-Patients, National Hospital for the  
Paralyzed and Epileptic, Queen Square ;

AND

PERCY SARGENT,

M.A., M.B., B.C. (CANTAB.), F.R.C.S.,

Surgeon to the National Hospital for the Paralyzed and Epileptic,  
Queen Square ; Surgeon to Out-Patients,  
St. Thomas's Hospital.

### Head-note.

INJURIES to the spine include—

1. Damage to the spinal column alone, which is serious, but relatively unimportant in contrast with—
2. Damage to the nervous structures, which may be followed by—
  - (a) Death—(i.) immediate, if the damage to the spinal cord is at or above the fourth cervical vertebra ; or (ii.) subsequent, after an interval of days, weeks, or months, from some complication, such as pneumonia or inflammation of the kidneys. Generally speaking, the lower the site of the injury to the spine, the longer will death be delayed.
  - (b) Paralysis, either complete or partial, varying in extent with the region of the spine injured.
  - (c) Loss of sensation, also varying in extent and completeness, and loss of control over the excreta.

- (d) Disease—(i.) of bladder and kidneys, arising from loss of control over the bladder; (ii.) of skin (bedsores), which may become infected. (See Infection.)
- (e) Traumatic neurasthenia, also known as “railway spine.”

### Technical Terms.

(For other technical terms, see Brain.)

*Ānæsthēsia*.—See Brain—Technical Terms.

*Ānālgēsia*.—See Brain—Technical Terms.

*Atlas*.—The first vertebra of the neck (cervical), upon which the skull rests. [Fig. 165.]

*Axis*.—The second cervical vertebra, upon which the atlas rests, and which possesses a bony process passing upwards towards the skull in front of the upper end of the spinal cord (odontoid process), displacement of which causes instant death. [Fig. 165.]

*Brachial Plēxus*.—The great bundle of nerves, situated above the collar-bone, which supply the upper limb. [Fig. 139.]

*Cānda Equīna*.—The bundle of nerves which occupies the spinal canal below the point at which the spinal cord comes to an end. So named from its resemblance to a horse's tail.

*Cŷtītis*.—Inflammation of the bladder.

*Glossy Skin*.—The smooth, shiny appearance presented by skin the nerves of which have been injured.

*Knee-Jerk*.—The reflex kicking movement elicited by striking the knee just below the kneecap. (See Brain—Technical Terms, Reflex, pp. 171, 172.)

*Mēdūllā Ōblōngāta*.—The expanded uppermost end of the spinal cord, which forms the commencement of the brain. [Figs. 39, 42, 43, 44, 45, 46, 49.]

*Motor Nerve*.—A nerve which conveys impulses from the central nervous system to the muscles, whereby they are made to contract. [Fig. 166.]

*Mŷēlītis*.—A softening or destruction of the spinal cord, due to inflammatory or other changes.

*Ōdōntōid Process*.—See above, Axis.

*Pāṡāplēgġā*.—Paralysis of the lower limbs.

*Plantar Reflex*.—See Brain—Technical Terms.

*Posterior Root Gāngliōn*.—A small swelling, situated upon the posterior root of a spinal nerve, close to the place at which it emerges from the spinal canal. It contains a number of nerve cells which are connected with sensation. [Figs. 167, 168.]

*Retention*.—Inability to empty the bladder.

*Root.*—A bundle of nerve fibres emerging from the spinal cord. Each spinal nerve has two such roots—an anterior or motor, and a posterior or sensory. [Figs. 166, 167.]

*Sensory Nerve.*—A nerve conveying sensations from the skin, etc., to the spinal cord, whence they are carried to the brain, thus producing impressions of touch, pain, temperature, etc. [Figs. 167, 168.]

*Spāstic.*—A condition in which the muscles are in a continual state of contraction, or contract in an exaggerated manner when stimulated.

*Surgical Kidneys.*—Abscesses in the kidneys due to the upward spread of inflammation from an inflamed bladder.

*Thēca.*—The firm fibrous covering of the spinal cord inside the bone, composed of dura mater. (See Brain, p. 170.) [Fig. 166.]

*Trāuma.*—An injury.

*Trāumātic.*—Due to an injury.

*Trōphic Ulcer.*—An ulcer formed in consequence of loss of sensory nerves to the skin.

*Vērtēbrā.*—One of the many small bones of which the spinal column is built up. [Fig. 165.]

### Anatomy and Physiology.

(A) *Anatomy.*—The spine, for the purpose of this article, consists of two essential parts—namely, the spinal column and the spinal cord.

1. The spinal column consists of 33 superimposed vertebræ, enclosing a continuous canal from the skull to the tip of the tail region, within which lie the nerve elements (Fig. 164). The vertebræ which compose it are divided into regions thus: 7 cervical, or neck, vertebræ; 12 dorsal vertebræ, to which the ribs are attached; 5 lumbar, or loin, vertebræ; 5 sacral, united into one piece, the sacrum, which closes in the bony pelvis behind; and 4 coccygeal vertebræ, or tail bones. The vertebræ are jointed to one another in the cervical, dorsal, and lumbar regions, and though the movements at the individual joints are slight, yet the combined range of movement in the spine as a whole is considerable. Between each pair of vertebræ is an aperture on either side through which a spinal nerve emerges (intervertebral foramen). The individual vertebræ are united together by strong ligaments, and are closely invested by a mass of muscles which bring about the movements of the spine.

Each vertebra forms a bony ring surrounding a segment of the spinal canal, and consists of a strong mass of bone in front, the body, and a lighter portion behind, the neural arch.

2. The spinal cord and spinal nerves (Fig. 139). The cord extends from the opening in the base of the skull, the foramen magnum, downwards for about 18 inches, and ends at the level of the second lumbar vertebra, just above the small of the back, and below this level the spinal canal contains the bundle of nerves known as the "cauda equina." Thus, a fracture of the spine in its lower part does not damage the spinal cord, but may injure the nerves of the cauda equina.

The cord, like the brain, consists of grey matter and white matter. (See Brain, p. 174.) The latter consists of nerve fibres, and the former both of fibres and nerve cells. The arrangement of grey and white matter in relation to one another is different in the brain and spinal cord, in that in the cord the white matter is mainly disposed upon the surface, and the grey matter deeply, whereas the reverse holds good in the case of the brain.

There are thirty-three pairs of spinal nerves, emerging each by two roots, an anterior and posterior, from the sides of the cord. [Figs. 166, 167, 168.] Each nerve leaves the spinal canal in close relation with the vertebra with which it corresponds in name; but, owing to the relative shortness of the cord as compared with the canal in which it lies, the point of emergence of the lower nerves from the cord lies at some distance above the point of emergence from the spinal canal; consequently the lower spinal nerves run for some distance within the lower part of the spinal canal, and it is these nerves which constitute the cauda equina.

Within each intervertebral foramen lies the posterior root ganglion. (See Technical Terms.)

The spinal canal is much larger than the cord which it encloses, an arrangement which allows it to be slung and packed within the canal in the best possible manner for its protection. In this way it is very much better protected from injury than is the brain. [Fig. 166.]

(B) **Physiology, or Functions.**—The spinal cord constitutes the great conducting path between the brain above and the trunk and limbs. It carries impulses both to and from the brain and cerebellum, the impulses (sensory, etc.) which pass upwards in the cord being called "afferent," and those which pass down (motor, etc.) in the cord being called "efferent."

The cord also contains what are known as "reflex centres" in its grey matter. Thus, if the cord is cut completely across in the dorsal region, so as to isolate it from any impulses coming

down from the brain, the bladder is able, for a while at least, to carry on its functions. Thus, in such circumstances, the bladder fills up to a certain point, and impulses pass from it to the reflex centre in the lumbar region, from which other impulses pass downwards and cause it to empty itself.

(C) **Coverings.**—Like the brain, the cord is invested by (*a*) a membrane which carries its bloodvessels, closely covering the cord, and called the “pia mater”; (*b*) a very thin, delicate membrane next to this, called the “arachnoid”; and (*c*) the strong fibrous membrane, lying next to the bones, and therefore at some distance from the cord, called the “dura mater,” and forming a complete sheath of investment, not only for the cord, but also for the nerves of the cauda equina, and called the “theca.” Between the arachnoid and pia mater is a space containing cerebro-spinal fluid, the subarachnoid space. [Fig. 165.]

Outside the theca, again, between it and the bony walls of the canal, is a mass of fat containing numerous large veins, which serve as an additional protection to the cord.

(D) **Bloodvessels.**—As already stated, the bloodvessels which supply the cord are contained in the pia mater, which at certain places penetrates into the substance of the cord.

(E) **Nerves.**—The arrangement of the nerves emerging from the cord has been sufficiently referred to above. [Figs. 166, 167, 168.]

### Consequences of Accident.

Damage to the spine may affect three parts :

1. **The Bones, etc., of the Spinal Column (without Damage to the Cord or Nerves).**—Direct blows, violent bending of the head forwards or backwards, falls across bars, etc., and severe wrenches or twists, may cause—

- (i.) Fracture of small pieces of vertebræ.
- (ii.) Laceration of ligaments or muscles of the back.
- (iii.) Partial dislocation of one or more of the joints between the vertebræ.
- (iv.) Injury to the coccyx.

The first two are readily recognized, and are rapidly recovered from, though pain and stiffness may remain for some time. The last occurs almost exclusively in the region of the neck, and gives rise to deformity, the nature of which is readily recognized by means of the X rays. If recognized at once,

reduction may be effected, but is not free from risk of injury to the cord.

Injury to the coccyx, as from falls, kicks, etc., is sometimes followed by a form of neuralgia, known as "coccygodynia." [Fig. 165.] It is commoner in women than in men, as parturition is the most frequent cause. It is also most common in the neurotic, and it may require an operation for its relief.

2. **The Spinal Cord.**—These injuries are of the most diverse character, varying with the region affected, and with the completeness with which the thickness of the cord is damaged. Injury to the cord gives rise to well-marked signs, dependent upon the loss of its conducting power. All the muscles whose nerves come off below the site of the injury are paralyzed, and there is loss of sensation below that point in addition. Loss of control over the evacuations, and alterations of the reflexes, are characteristic features. When the injury to the cord is only partial, the paralysis will be incomplete, as also will the loss of sensation.

These injuries may be classed as under :

(i.) *Concussion.*—This injury may give rise to a variety of symptoms, which are in part due to the spinal injury, and in part to a simultaneous concussion of the brain. (See Brain and Insanity.)

The symptoms are transient paralysis, or loss of sensation in the parts supplied by nerves below the seat of injury.

(ii.) *Contusion.*—Occasionally it happens that, in the neck (cervical) region especially, two vertebræ are displaced from one another at the moment of the accident, and immediately regain their natural place, the cord having been momentarily pressed upon. This momentary pressure may have been sufficient to damage the cord severely, but it may have been so slight as to cause but a transitory interference with its conducting power. To such an injury as the latter the term "contusion" is given, and, if unaccompanied by any other damage, it is quickly and permanently recovered from.

(iii.) *Laceration.*—The cord may suffer partial or complete division at the point of injury, either from momentary displacement of bones, as mentioned above, or by gross and permanent displacement, as in a fracture dislocation. Recovery is only possible to the extent to which the cord may have escaped division.

(iv.) *Compression.*—Instead of being torn, the cord may be

pressed upon by blood effused between the bone and theca, or even into the substance of the cord itself; or by displaced fragments of bone; or, later, by the products of inflammation. (See Disease.) Recovery, either partial or complete, is possible if the pressure is early removed by operation. If neglected, changes are set up in the cord which render recovery difficult or impossible.

3. **The Cauda Equina.**—If the fracture or fracture dislocation is below the point at which the cord ends, the cord itself escapes, but the nerves of the cauda equina may suffer damage, either by compression or laceration, and the symptoms will depend upon the particular nerves which happened to have been injured. When the injury involves the cauda equina, there will be paralysis and wasting of the muscles corresponding to the particular nerves injured; alteration of sensibility; and loss of control over the bladder, if its nerves have been involved.

#### Disease.

1. **Caused by the Accident.**—(a) *Caries of the spine* (Pott's disease). In some cases the first signs of this disease may appear after an injury to the spine in tuberculous subjects. (For Caries, see Bones, p. 126.)

(b) *Rheumatoid-arthritis* of the joints between the vertebræ is apt to follow injuries to the spinal column in patients past middle life. (For Rheumatoid Arthritis, see Joints, p. 494.)

(c) *Functional Disease.*—See Neurasthenia.

(d) *Organic Disease.*—It is possible that some forms of organic disease (sclerosis) of the cord may originate in an injury, or, in a person predisposed to such disease, be determined by an accident.

(e) *Myelitis*—namely, a softening of the cord, due to inflammatory or degenerative changes—may spread upwards so as to involve the cord above the actual site of the injury, and cause death from implication of important centres.

(f) *Bedsore*s are extremely apt to form in persons paralyzed from spinal injury. These may become huge sloughing ulcers, and give rise to abscesses and pyæmia.

(g) Owing to the loss of control over the bladder, *inflammation* of the organ is particularly liable to occur. This inflammation may spread up the kidney ducts (ureters) to the kidneys, and cause death from “surgical kidney.”

(h) When the injury to the cord is so high as to cause paralysis of the muscles of the chest, the movements of the

lungs are so interfered with that *pneumonia* is likely to occur, and death to take place from that cause.

2. **Existing before the Accident and aggravating its Effects.**—The effects of a spinal injury are liable to be made worse by old age or any previous condition of ill-health. Those suffering from any affection of the lungs, such as chronic bronchitis, and those suffering from either kidney or bladder disease, or any obstruction of the passage of urine, such as enlargement of the prostate (the gland surrounding the neck of the bladder in the male), are particularly liable to become worse after injury to the spine.

Pre-existent disease of the cord, whether functional or organic, may be made worse by an injury to the spine. Pre-existent disease of the spinal column (*e.g.*, Pott's disease) is liable to be aroused to greater activity by an injury.

### Operation.

Operation may be required—

1. To rectify a deformity from injury to the bones of the spinal column.

2. The operation of laminectomy, or opening up of the spinal canal from behind by removal of vertebral arches, is called for whenever there is any reason to think that the spinal cord has not been irrevocably destroyed at the site of the injury, but that its functions are being interfered with by pressure of effused blood, fragments of bone, or inflammatory products.

3. For relief of pressure upon the nerves of the cauda equina or for relief of persistent pain from involvement of a posterior nerve root in a fractured vertebra.

4. Removal of the coccyx is sometimes called for in order to relieve coccygodynia. (See above, p. 747.)

The first two operations are attended with considerable risk, on account of the severity of the injury which has necessitated them.

### Cure and Return to Work.

1. **After Injury to the Spinal Column.**—When the injury has been slight, the patient may eventually become so far recovered as to resume his ordinary work. The nature of the work is of course an important factor. Thus, a clerk would be able to resume work long before a gardener.

2. **After Injury to the Spinal Cord itself or the Cauda Equina.**—Concussion and contusion of the cord may be com-



pletely recovered from after some months of treatment. But the length of time required and the completeness of the recovery depend upon numerous factors, amongst which are the physical condition of the patient, his environment, age, stability of his nervous system, and his freedom from mental worry. If the cord has been lacerated, only partial recovery is possible, and that only to the degree to which the cord has remained untorn, for regeneration such as occurs in the nerves (*vide infra*) does not take place in the spinal cord. When the cord has been torn completely across, the length of time the patient may survive depends upon the level of the injury and upon the skilfulness of the nursing. Generally speaking, the higher the level of the injury the shorter will be the period of survival. When the cauda equina has been injured, the patient may, though paralyzed to a greater or lesser extent, live for many years, and die eventually from some condition wholly unconnected with the injury.

When the cord has suffered damage from pressure alone, recovery, though very slow, may eventually be almost complete, provided that the operation for removal of that pressure has been done immediately or very soon after the accident. The longer operation is delayed, the less is the prospect of cure. Recovery takes place in periods varying from six months to two years.

Few of those who have suffered from a really severe injury of the spinal cord or cauda equina are ever able to return to heavy work. Some are able to perform light work under favourable conditions of labour. The vast majority of patients who survive a severe injury to the spine are permanently incapacitated from earning their livelihood.

#### Recurrence.

There is no likelihood of recurrence of the consequences of accident to the spinal cord.

#### Occupation Diseases.

We are not aware of any occupation disease which especially affects the spinal cord other than caisson disease and poisons, more particularly the metals, such as lead.

#### Diagnosis.

Fracture and dislocation of the spinal column produces characteristic deformity. The exact position of the bones with

relation to one another can be ascertained by means of the X rays. Serious injuries of this nature are rarely unaccompanied by injury to the spinal cord or nerves, but, on the other hand, there may be the most extensive damage to the spinal cord without serious damage to the spinal column.

The diagnosis of injury to the spinal cord depends upon a knowledge of its anatomy and physiology. (See above.) Generally speaking, there are paralysis and loss of sensation in the parts of the body supplied by the cord below the seat of the injury, together with alteration of the reflexes. The loss of sensation and the paralysis may be complete or partial, according to the extent of the damage done, and temporary or permanent, according to the amount of actual destruction of nerve tissue, or whether means have been taken to relieve such interference of function as may have been due to compression.

### Malingering.

Weakness in the legs or arms, alterations of sensation, and persistent pain, may all be feigned after a spinal injury. Systematic examination rarely fails to detect the malingerer. He may pretend weakness of the legs, but he cannot alter the character of the reflexes which distinguish an organic lesion of the spinal cord. He is always prone to exaggerate his symptoms, so that not only will he make no attempt to walk, but he will make no attempt to move the legs when in bed. His muscles will waste from disuse, but he cannot alter their normal electrical reactions. He will make exaggerated statements both with regard to the nature of the accident and his ailments.

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*For legal cases of injury to the Spinal Cord, see CASE GUIDE :  
Spinal Cord.*

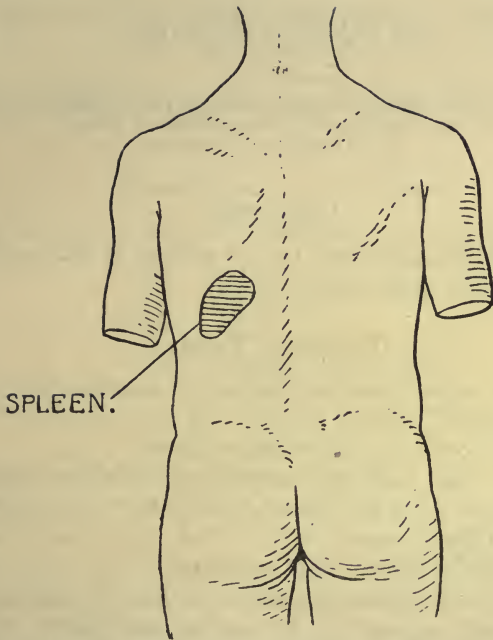


FIG. 169.—BACK VIEW OF THE THORAX, SHOWING THE RELATIVE POSITION AND SIZE OF THE SPLEEN.

# SPLEEN.

By JAMES SHERREN,

F.R.C.S.,

Surgeon to the London Hospital ; Surgeon to the Poplar Hospital  
for Accidents ; late Erasmus Wilson Lecturer,  
Royal College of Surgeons.

## Head-note.

THE chief danger of injury to the spleen is that of bleeding into the abdomen (peritoneal cavity).

## Technical Terms.

*Cōlon*.—The large bowel, excluding its terminal part, which is called the "rectum." [Figs. 2, 9.]

*Cyst*.—An abnormal cavity containing fluid.

*Dīāphragm*.—The muscular partition between the cavities of the chest and belly. It is an important muscle in the mechanism of respiration. [Figs. 2, 3, 4.]

*Gastrō-Splēnic Ōmēntum*.—See Omentum.

*Līgament*.—A peritoneal ligament is a fold of peritoneum connecting two solid organs, as the spleen and kidney (lienorenal ligament), or running to a solid organ from the abdominal wall (the ligaments of the liver). (See Hernia.)

*Ōmēntum ; Gastro-Splenic Omentum* (stalk or pedicle of the spleen).—A fold of peritoneum between the stomach and the spleen.

*Pēdīcle*.—See Gastro-Splenic Omentum.

*Pēřitōnēum*.—The membrane lining the belly wall and covering the contained organs. [Figs. 149, 150, 151, 152.]

*Plēūra*.—The membrane lining the cavity of the chest and covering the lungs. [Fig. 137.]

*Plēūrīsy*.—Inflammation of the pleura.

*Stalk of Spleen*.—See Gastro-Splenic Omentum.

## Anatomy.

The spleen is an organ of a somewhat pyramidal shape. It is situated on the left side of the upper part of the abdomen,

below the diaphragm and under cover of the ribs. It weighs, on an average, from 4 to 6 ounces, but in some diseases, notably in malaria (ague), these weights are much exceeded.

The spleen is a solid organ, very friable, and contains many bloodvessels. Its exact function is not fully known; it is intimately connected with the bloodvessels, and has to do with maintaining the normal composition of the blood.

The spleen is almost completely covered with peritoneum, which forms a fold or stalk (gastro-splenic omentum) between it and the stomach. It is connected to the kidney by a peritoneal ligament (the lieno-renal), and lies close to part of the large intestine (splenic flexure). [Figs. 131, 169.]

### Consequences of Accident.

As the result of abdominal accidents the spleen may suffer—

- (i.) Contusion.
- (ii.) Wounds.
- (iii.) Rupture.
- (iv.) Twisting of its stalk.

(i.) **Contusion.**—As the result of a blow or crush, bleeding may take place into the substance of the spleen. This is usually recovered from spontaneously. In some cases an abscess forms, which, unless opened early, may spread outside the spleen and form an abscess under the diaphragm. The inflammation may spread to the cavity of the chest. The patient is liable to all the usual complications (blood-poisoning, etc.) that result from the formation of matter (pus) in the body.

(ii.) **Wounds.**—These rarely occur in civil life. The spleen may be wounded by the end of a broken rib. In order to wound the spleen, the fracture must be the result of direct violence, and then in most cases the diaphragm will also be injured.

(iii.) **Rupture.**—This is usually the result of violence to the left side of the upper abdomen or to the left lower ribs. It results in bleeding into the abdomen (peritoneal cavity). This may be fatal within a few minutes, or, on the other hand, there may be sufficient time to allow of surgical intervention.

When the spleen is enlarged from disease, especially from malaria, rupture may take place as the result of very slight violence—*e.g.*, a sudden strain, or springing aside to avoid a blow. If the rupture is small, the blood which escapes may

not be enough to endanger life, and may be entirely absorbed in the body without further complication.

On the other hand, the effused blood may become infected and form an abscess. This infection is particularly liable to happen if the large bowel in the immediate neighbourhood be bruised, for this bowel is always full of microbes.

Rupture of the spleen is not uncommonly complicated by fracture of ribs.

(iv.) **Twisting of the Stalk of the Spleen.**—The blood-vessels supplying the spleen pass into it in the fold of peritoneum which attaches it to the stomach (the gastro-splenic omentum). Occasionally this attachment of the spleen to the stomach is looser than normal, and allows the spleen to be movable.

Under these circumstances an abdominal injury, a contusion or a sprain, may cause the spleen to rotate, twisting the stalk, and so interfering with the supply of blood. This will give rise to severe pain and vomiting, and may lead to the formation of an abscess of the spleen, with peritonitis.

### Disease.

#### 1. Produced by the Accident—

- (a) Hæmorrhage into the spleen.
- (b) Formation of a cyst.
- (c) Abscess.
- (d) Twisting of the stalk of the spleen (torsion of pedicle).
- (e) Inflammation round the spleen (perisplenitis).
- (f) Bleeding into the abdomen (intraperitoneal hæmorrhage).
- (g) Abscess: subdiaphragmatic, intraperitoneal.
- (h) Peritonitis.
- (i) Pleurisy.
- (j) Lardaceous or amyloid disease.

(a) **Hæmatoma.**—Blood poured out into the substance of the spleen may collect into one spot. This blood may be partially absorbed, or a tumour (cyst) containing fluid may permanently remain, and may cause the spleen to be enlarged and result in pain.

(b) **Formation of Cyst.**—This may occur from an accident, as the result of bleeding into the spleen. The cyst may become infected, leading to the formation of an abscess.

(c) **Abscess.**—See above, and see Contusion and Twisting of the Stalk of the Spleen.

(d) **Twisting of Stalk of the Spleen.**—See above.

(e) **Inflammation round the Spleen (Perisplenitis).**—Inflammation round the spleen may result from bleeding into it, from abscess formation, or from twisting of its pedicle.

(f) **Bleeding into the Abdomen (Intraperitoneal Hæmorrhage).**—See above, Contusion.

(g) **Abscess in the Abdomen: Subdiaphragmatic, Intraperitoneal.**—See Contusion, Rupture.

(h) **Peritonitis.**—This may be local or diffuse, and arise from the effects of a twisting of the stalk of the spleen, or from spread of an abscess of the spleen, or from infection of blood which has been poured out into the abdomen (peritoneal cavity).

(i) **Pleurisy (Inflammation of the Covering—Pleura—of the Lungs).**—This may result from the same injury to the chest as produced the rupture of the spleen. It may complicate associated fractures of ribs. Pleurisy may also be set up by spread of inflammation of the spleen (caused by accident) extending through the diaphragm.

(j) **Lardaceous or Amyloid Disease.**—The spleen may become enlarged as the result of the deposition in it of a peculiar waxy substance called “amyloid” or “lardaceous” material. This deposition occurs in cases of long-standing inflammation of bone, such as may result from injury. (See Infection, p. 449.)

2. **Existing before the Accident and aggravating its Effects.**—(a) **Enlargement of Spleen due to Malaria or Other Disease.**—This is most important, for enlargement of the spleen may lead to rupture as the result of very slight violence.

(b) **Movable or Wandering Spleen.**—A spleen which is abnormally movable from any cause may suffer from a twisted stalk as the result of accident.

### Operation.

(i.) **Contusion of Spleen.**—No operation is necessary in an uncomplicated case of contusion of the spleen. If an abscess forms, it should be opened and drained early. The operation itself is not dangerous, but the condition for which it is performed is fatal if left untreated.

(ii.) **Wounds.**—Operation may be required if bleeding into the abdomen (intraperitoneal hæmorrhage) arises, and will be of the same nature as that performed for rupture.

(iii.) **Rupture.**—In this condition immediate operation is necessary to save life. The operation, which usually consists in removal of the spleen, will be successful in about 85 per cent. of cases of rupture of a healthy spleen. If, however, the spleen is enlarged as the result of disease, the death-rate is much higher.

(iv.) **Twisting of Stalk.**—If the patient is to be restored to perfect health, an operation to refix the spleen in position is necessary. The risk of this is small. The operation may have to be undertaken soon after the accident, as the twisting may cut off the blood-supply. Operation at this stage is grave, and would consist in most cases of removal of the spleen.

(v.) **Abscesses of the Abdomen.**—Abscess under the diaphragm (subdiaphragmatic abscess) is a grave complication. The abscess must be opened and drained, in most cases through the cavity of the chest. The death-rate is high, but the condition is invariably fatal if left.

Drainage of an intraperitoneal abscess is necessary; the outlook is much better than in the case of subdiaphragmatic abscess.

#### Cure.

After an operation for rupture of spleen or for refixing a movable spleen, surgical cure should be complete in six weeks if no complications have arisen.

No time can be given for cases in which an abscess has had to be opened and drained, or in which peritonitis has supervened. Until all wounds have healed the patient cannot be considered cured. (Return to Work, p. 757 [*b*].)

#### Return to Work.

The time at which a patient will be able to resume work, and the kind of work which he can undertake, will depend upon—

- (a) The amount of blood lost at the operation.
- (b) The condition of the abdominal wall.
- (c) The changes in the general condition of the patient if the spleen has had to be removed.

(a) The anæmia due to the loss of blood may persist for months, and if the patient is above middle age severe loss of blood will probably never be recovered from, and he will never be fit for hard work.



(b) A large opening into the abdomen is often necessary in order to remove a ruptured spleen. This operation may have to be carried out very hastily, as the condition is dangerous; and, further, the operation wound in the abdomen has also to be sewn up in a hurry, as the state of exhaustion of the patient, consequent on the loss of blood from the ruptured spleen, may prevent a lengthy operation. This wound may be followed by a weak scar, which will prevent the patient from being able to do laborious work without a further operation to the abdominal wall. (See Rupture—Ventral Hernia, p. 693.)

(c) The spleen is not necessary to life. There are in many cases rudimentary spleens present in the body which may enlarge and compensate for the absence of the spleen. In other cases glands of another nature (lymphatic glands) enlarge, and, by fulfilling the functions of the spleen, enable the work of the body to be carried on.

After a ruptured spleen has been removed, there is no reason why a patient should not get well. Under the most favourable circumstances he should be able to work in three months from the date of operation. The present writer has several such at work.

Obscure blood-changes have been noted from time to time after removal of the spleen, associated with slight enlargement of the superficial glands; but these do not interfere with the capacity for work.

In a few cases a train of symptoms, which may effectually prevent work, follow removal of the spleen. These are: wasting, thirst, rapidity of the pulse, anæmia, drowsiness, and griping abdominal pains.

It is not known whether removal of the spleen renders the patient liable to other diseases.

When grave complications, such as abscess under the diaphragm (subdiaphragmatic abscess), have arisen, no time can be given within which the patient will be able to resume work. It is probable that the patient will never be fit for heavy work again, but might be expected to do light work two months after all wounds have soundly healed.

### Recurrence.

If the spleen has once been twisted, the condition may recur unless refixed by operation.

### Occupation Diseases.

No occupation carries with it any special danger of accidents involving the spleen. Residence in the tropics or malarial countries is commonly associated with an enlarged spleen.

### Diagnosis.

Pre-existing disease will only be discovered at operation.

### Malingering.

There are no special points beyond those mentioned under Abdomen.

*For legal cases of injury to the Spleen, see CASE GUIDE: Spleen.*

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## SPRAINS.

*See* JOINTS, MUSCLES, TENDONS.

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## STINGS.

OF INSECTS. *See* TROPICS

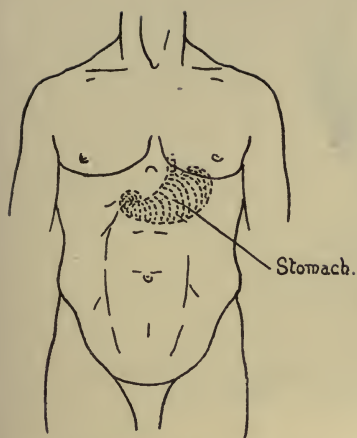


FIG. 170.—CHEST AND ABDOMEN SEEN FROM THE FRONT, SHOWING THE POSITION AND RELATIVE SIZE OF THE STOMACH.

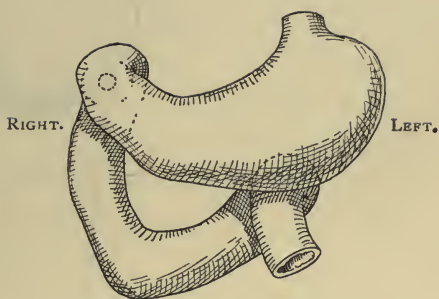


FIG. 171.—STOMACH WITH THE FIRST PART OF THE SMALL INTESTINE, THE DUODENUM.

The small dotted circle to the right indicates the circular valve which closes the right end of the stomach, the pylorus and pyloric valve.

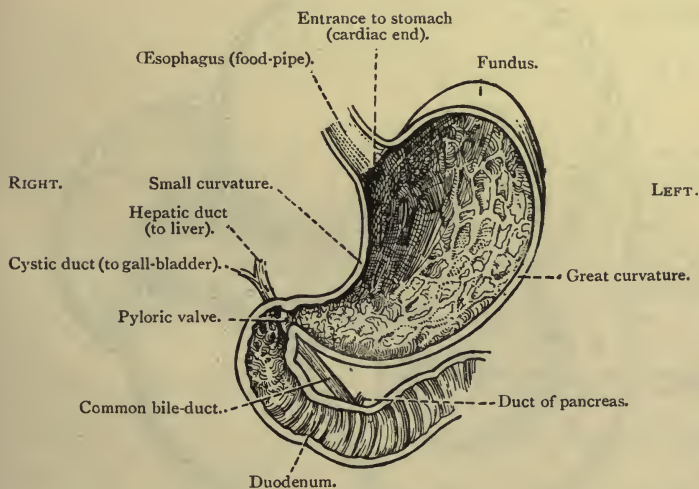


FIG. 172.—STOMACH AND DUODENUM IN ABOUT THEIR POSITION IN THE BODY, OPENED FROM THE FRONT.

The ducts for the bile, the common bile-duct, and for the secretion from the pancreas, are seen opening by a common opening into the first part of the small intestine, the duodenum.

(From Buchanan's "Anatomy.")

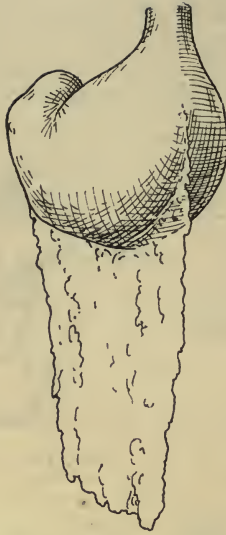


FIG. 173.—THE STOMACH DIAGRAMMATICALLY REPRESENTED, AS SEEN FROM THE LEFT SIDE.

From the lower border, the great curvature, hangs the apron of the abdomen, the great omentum.

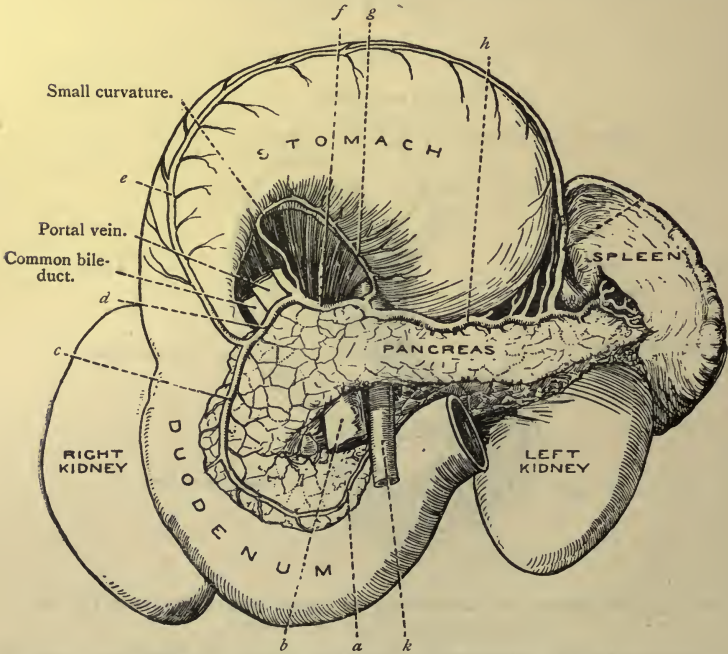


FIG. 174.—THE STOMACH AND ORGANS NEAR IT.

The two kidneys, the duodenum, the pancreas and spleen, are all in their normal positions. The stomach is simply lifted up from the front, and the illustration shows what is beneath, or rather behind, it. The great omentum is cut away, and the letters *a* to *k* refer to named parts, chiefly bloodvessels. The duodenum is of course cut. The upper part of this illustration lies in contact with the diaphragm.

(From Buchanan's "Anatomy.")

# STOMACH.

BY JAMES SHERREN,

F.R.C.S.,

Surgeon to the London Hospital ; Surgeon to the Poplar Hospital.  
for Accidents ; late Erasmus Wilson Lecturer, Royal  
College of Surgeons.

## Head-note.

THE dangers resulting from injury to the stomach are death from shock, or peritonitis due to the escape of the contents of the stomach into the cavity of the abdomen.

## Technical Terms.

*Diaphragm.*—The muscular partition between the chest and abdomen. It is an important breathing muscle. [Figs. 3, 4.]

*Duodenum.*—The first twelve finger-breadths of the small bowel. [Figs. 149, 171, 174.]

*Epigastrium.*—The pit of the stomach. [Fig. 1.]

*Empyema.*—A collection of matter in the chest (pleural cavity).

*Fistula.*—An abnormal communication between a hollow organ and the surface of the body, or between two hollow organs.

*Œsophagus (or Gullet).*—The tube which carries the food from the mouth to the stomach. (See Œsophagus, p. 599.) [Figs. 2, 148.]

*Omentum.*—A fold of peritoneum attached to the stomach. [Fig. 173.]

*Pleura.*—The membrane lining the cavity of the chest and covering the lungs. [Fig. 137.]

*Pleural cavity.*—The potential space between the chest wall and the lungs. [Fig. 137.]

*Pleurisy.*—Inflammation of the pleura.

*Peritonæum.*—The membrane lining the abdomen, and covering its organs. (See Peritoneum.) [Figs. 151-153.]

## Anatomy.

The stomach is a somewhat pear-shaped dilatation of the alimentary canal, situated immediately beneath the diaphragm

and liver and close to the spleen. It is deeply placed under cover of the ribs, and when empty is well protected from injury; but when full it protrudes from under cover of the ribs, and is then more liable to injury. [Figs. 2, 170, 171, 172, 173, 174.]

The stomach has three coats or layers: the innermost is the mucous membrane, secreting the gastric juice; the middle coat consists of muscle fibres; and the outermost is of peritoneum.

The stomach is completely sheathed in peritoneum, except for a small area at its upper end which is directly attached to the diaphragm.

The opening by which food enters the stomach from the œsophagus is called the "cardiac orifice," that by which food leaves it the "pyloric orifice" or "pylorus." [Figs. 171, 172.]

The upper border of the stomach is called the "lesser curvature," the lower border the "greater curvature." From the cardiac orifice there is a leftward dilatation, which is called the "fundus."

The peritoneal folds attached to the stomach are called "omenta."

The small or gastro-hepatic omentum passes from the upper border (lesser curvature) of the stomach to the liver. The great omentum passes downwards from the lower border (greater curvature), and then turns backwards on itself, forming an apron which covers the abdominal contents. In its course to the back wall of the abdomen, the great omentum encloses between its layers the portion of the large bowel which lies across the abdomen. The gastro-splenic omentum is a fold of peritoneum which stretches between the spleen and stomach, to which it is attached at the fundus.

The capacity of the moderately full stomach is about 4 pints.

### Consequences of Accident.

The stomach may suffer from—

- (i.) Wounds.
- (ii.) Rupture.

(i.) **Wounds.**—Penetrating wounds of the abdominal wall may wound the stomach. The effect will depend on the size of the wound and the distension of the stomach. Small wounds

to hollow organs are not necessarily followed by escape of their contents. The lining (mucous membrane) of the stomach is loosely attached to its muscular coat, and may protrude into the wound, closing it. Peritonitis, by producing adhesion of the stomach to the abdominal wall or to the liver, may also close up the wound. Usually, however, the wound is followed by an immediate escape of the irritating contents of the stomach, which unless dealt with by operation inevitably sets up peritonitis.

In rare cases, in which the stomach is close to the abdominal wall at the time of the accident, the contents escape externally, and the hole so formed remaining unclosed, a gastric fistula is the result.

(ii.) **Rupture.**—Rupture of a normal stomach may result from injury to the pit of the stomach (epigastrium). It is most likely to occur when the organ is full. The rent is commonly at the pyloric region. Usually it penetrates all the coats of the stomach, with consequent escape of the contents into the abdomen (peritoneal cavity). Occasionally the rupture is partial, not involving the peritoneal coat of the stomach. This partial rupture may lead to interference with the functions of the stomach through the formation of scar tissue during healing.

### Disease.

#### 1. Produced by the Accident.—

- (a) Peritonitis.
- (b) Abscess under the diaphragm or elsewhere.
- (c) Pleurisy.
- (d) Gastric fistula.
- (e) Dilatation of the stomach.
- (f) Adhesions.

(a) **Peritonitis.**—Whether the peritonitis be localized or general (diffuse) will depend upon the seat of the wound, rupture, or ulcer, and also upon the condition and contents of the stomach. When a wound, rupture, or giving way of an ulcer, occurs in the front wall of a full stomach, a general inflammation (diffuse peritonitis) of the lining of the abdomen rapidly follows. When a similar accident happens to an empty stomach, the peritonitis which follows may be localized round the wound.

(b) **Abscess.**—A localized peritonitis may develop into an

abscess under the diaphragm. A diffuse peritonitis may lead to the formation of an abscess anywhere in the abdominal cavity.

(c) **Pleurisy.**—This may result from the spread of the inflammation, due to accident to the stomach, through the diaphragm to the membrane lining the chest. This may cause an accumulation of fluid in the chest (a pleural effusion), which may become matter or pus (an empyema).

(d) **Gastric Fistula.**—As the result of a wound or rupture of the stomach, some or all of the contents of the stomach may escape on to the surface of the body.

(e) **Dilatation of the Stomach.**—The process of healing of the wound or rupture may constrict the stomach, and so interfere with the passage of food. A general enlargement of the stomach (dilatation of the stomach or enlargement of one part only—hour-glass stomach) may be produced by the distension of the part behind the constriction.

A general or partial dilatation of the stomach, following on peritonitis, may be the result of constriction due to adhesions pressing on the stomach. These adhesions may be caused by injury to any of the organs in the region of the stomach.

(f) **Adhesions.**—Adhesions may form from injury to the stomach itself, or to the liver, or to the biliary passages, or to any of the organs in the region of the stomach. These, if situated at the pylorus, may result in dilatation of the stomach; but if situated in other parts of the stomach may lead to pain or to vomiting.

## 2. Existing before the Accident and aggravating its Effects.—

(a) **Gastric Ulcer.**—The stomach and the small bowel immediately beyond it are not infrequently the seat of ulceration. These ulcers are usually caused by disease, and it is only in very rare instances, if ever, that an injury to the stomach plays any part in their development. Nevertheless these ulcers are most important from the point of view of accidents, because they may give way under a sudden strain, such as lifting a heavy weight. As a rule they give rise to symptoms, such as pain and vomiting of blood, by which their presence is diagnosed. In a few cases no symptoms are present until the time of actual rupture. The giving way of the ulcer allows the stomach contents to escape, and sets up a local or general peritonitis.



The stomach, when it is the seat of ulcers, may be ruptured by even slight violence, as passing the tube of a stomach-pump down into the stomach.

(b) **Œsophageal Piles.**—Dilated veins, at the junction of the œsophagus and the stomach, “Œsophageal piles,” are a very common consequence of congestion of the liver, especially that form due to excessive alcoholism. They frequently bleed into the stomach, and this blood may be vomited. The bleeding occurs spontaneously, not as a result of an accident.

### Operation.

Owing to the danger of peritonitis supervening, immediate operation is urgently necessary in wounds or ruptures of the stomach. As in all other sudden and serious abdominal disease, the danger is in delay.

In the event of these injuries being uncomplicated by injuries to other structures, operation, if undertaken within the first ten or twelve hours, will save life in the majority of cases ; but if delayed for twenty-four hours over 50 per cent. will die, and if postponed for forty-eight hours will scarcely ever prove successful. The operation consists in opening the abdomen, closing the rupture or wound, and providing for drainage, if necessary.

(a) **Gastric Ulcer.**—If a gastric ulcer gives way and discharges the contents of the stomach into the abdominal cavity, it must be treated by immediate operation. If this is done in the first twelve hours, certainly 95 per cent. of the patients will recover ; if done at the end of forty-eight, perhaps 5 per cent.

(b) **Peritonitis.**—In diffuse peritonitis, operation consists in opening the abdomen, closing the opening in the stomach, and providing for drainage. Few patients recover from a diffuse peritonitis when due to the escape of the contents of the stomach.

(c) **Abscess under the Diaphragm.**—Subdiaphragmatic abscess is a serious complication. The abscess must be opened and drained. In most of the cases the opening is made through the cavity of the chest after removal of part of a rib. There is a grave danger of infection of the chest cavity. Even when the operation is successfully performed, the death-rate is over 20 per cent.

(d) **Gastric Fistula.**—The stomach being adherent to the

abdominal wall, operation consists in freeing it and closing up the opening. The danger consists in the possible escape of stomach contents into the peritoneal cavity during the operation.

(e) **Dilatation of the Stomach.**—Whether this be due to the presence of adhesions from old peritonitis, or to the contraction of scar tissue from an ulcer, it can be effectually relieved by operation. The operation usually consists in providing another way (short-circuiting) by which the food can pass out of the stomach into the intestine. This is done by uniting the small intestine (the jejunum) to the back wall of the stomach (gastro-jejunosomy).

In a few cases an operation to enlarge the stomach's outlet (pyloric orifice) may be performed. The risk of either of these in the hands of a skilled surgeon is small. Individual operators have a death-rate of less than 1 per cent.

(f) **Adhesions.**—Division of these in some cases is necessary. It is an operation practically devoid of risk.

### Cure.

If uncomplicated recovery ensues after an operation for a rupture or wound of stomach, or for the giving way of an ulcer, cure may be expected in three months. Drainage for peritonitis or for a local abscess will prolong indefinitely the time necessary for recovery. In these cases cure may be expected a month after the wound has healed.

(a) **Gastric Fistula.**—Cure can be considered complete one month after the wound has healed.

(b) **Abscess under the Diaphragm (Subdiaphragmatic Abscess).**—Cure cannot be expected before six months after operation, and may be much later.

(c) **Dilatation of Stomach.**—Cure can be expected in two months from the date of operation. The cure in most cases is complete, but occasionally, after the operation for short-circuiting, obstruction at the new opening causes vomiting, which may interfere with complete cure, or necessitate a second operation.

(d) **Division of Adhesions.**—Surgical cure may be looked for two months from the date of operation. But it must be remembered that in many cases these operations are very unsatisfactory, as the adhesions re-form or the pain continues.

### Return to Work.

After operation the capacity for work and the time of return to work will depend upon—

1. The condition of the stomach.
2. The condition of the abdominal wall.
3. The presence of adhesions.

After an operation on the stomach, where the abdominal wound was closed at the time of the operation and the subsequent recovery was uninterrupted, work should be resumed in three months from the date of operation, and there is no reason why heavy work should not be undertaken.

If from the presence of adhesions there is pain after food, or during heavy work involving lifting, the patient may be debarred from heavy work, and there is no certainty that he will be cured even by an operation. (See Abdomen, p. 46.)

### Recurrence.

The only conditions calling for consideration in respect of recurrence are those of adhesions and of gastric ulcer.

**Adhesions.**—There is special liability to recurrence in the cases due to adhesions.

**Gastric Ulcer.**—The gastric ulcer so common in anæmic servant-girls may present symptoms which appear to be due to a recurrence of the ulcer. The ulcer is extremely chronic, and may show periods of quiescence and activity. During the quiescence the girl may think she is cured, and when she again suffers from the symptoms—*e.g.*, vomiting of blood and pain in the stomach—she thinks that it is a recurrence of the ulcer, while in fact it is merely a reappearance in severer form of the old symptoms. This reappearance might coincide with an accident which in no way affected the ulcer.

### Occupation.

There is no occupation which carries with it any special liability to injuries of the stomach.

### Diagnosis of Pre-existing Disease.

Apart from a history of disease gained from the patient, pre-existing disease can only be discovered at the operation.

Bleeding due to the rupture of "Œsophageal piles" cannot

be diagnosed with certainty. If profuse bleeding from the stomach occurs in a middle-aged man, even in whom there have been no previous symptoms of disease of the stomach, this condition may be suspected, and the suspicion will become almost a certainty if he is an alcoholic and cirrhosis of the liver is present.

#### **Malingering.**

There is nothing special to note. (See Abdomen, p. 47.)

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*For legal cases of injury to the Stomach, see CASE GUIDE: Stomach.*

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### **SUPPURATION.**

*See* INFECTION.

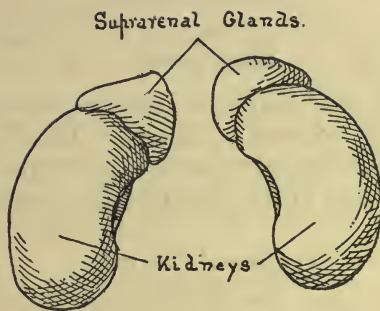


FIG. 175.—SKETCH OF THE TWO SUPRARENAL GLANDS, SITUATED IN THEIR NATURAL POSITION ON THE SUMMIT OF THE TWO KIDNEYS.

# SUPRARENAL GLANDS.

By JAMES SHERREN,

F.R.C.S.,

Surgeon to the London Hospital ; Surgeon to the Poplar Hospital  
for Accidents ; late Erasmus Wilson Lecturer, Royal  
College of Surgeons.

## Head-note.

DESTRUCTION of the suprarenal glands produces a train of symptoms called "Addison's disease." This is characterized by gradual failure of strength, feebleness of pulse, pigmentation of the skin, irritability of the stomach, and death.

## Technical Terms.

See Kidney.

## Anatomy.

The suprarenal glands are two flattened organs which are placed above and in contact with the kidneys.

They are roughly pyramidal in shape, soft in consistency, and weigh together about  $\frac{1}{4}$  ounce.

They contain many bloodvessels, and are intimately connected with the nerves of the abdomen.

Their exact function is not certainly known. [Fig. 175.]

## Consequences of Accident.

These glands are little liable to injury alone. They may be found injured after death from severe abdominal contusions in which other organs suffer.

It has been stated that Addison's disease has followed a blow upon the back or the abdomen. This may be so, but the connection between the injury and the disease is open to grave doubt. Addison's disease is due in the vast majority of cases to tuberculosis involving the suprarenal glands.

### Disease.

1. **Caused by the Accident.**—See above, Consequences of Accident.

2. **Existing before the Accident and aggravating its Effects.**—Probably in all cases in which the symptoms of Addison's disease appear after an injury there was pre-existing tubercular disease of these glands. It is very doubtful if the injury had anything to do with the appearance of symptoms of the disease.

### Operation.

There is no operation known to be of any use in the case of diseased suprarenal glands.

### Cure.

Addison's disease is at present incurable, and although good effects have followed, in a few cases, the administration of an extract made from the suprarenal glands of sheep, the treatment has been disappointing.

### Return to Work.

The disease being incurable the diseased man cannot return to work.

### Occupation Diseases.

There is no relationship known to exist between Addison's disease and any particular occupation.

### Diagnosis.

The symptoms produced by loss of function of the suprarenal glands are not caused by disease of any other organ.

### Malingering.

The symptoms due to a loss of function of the suprarenal glands cannot be simulated.

Pigmentation of the skin due to a stain or to the administration of arsenic could not mislead, as the important symptoms, the circulatory weakness and failure of strength, could not be imitated. Pigmentation of the skin without other symptoms is not due to suprarenal gland disease.

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## SWEEP'S CANCER.

See GENITAL ORGANS—MALE, p. 397, AND SKIN, p. 735.

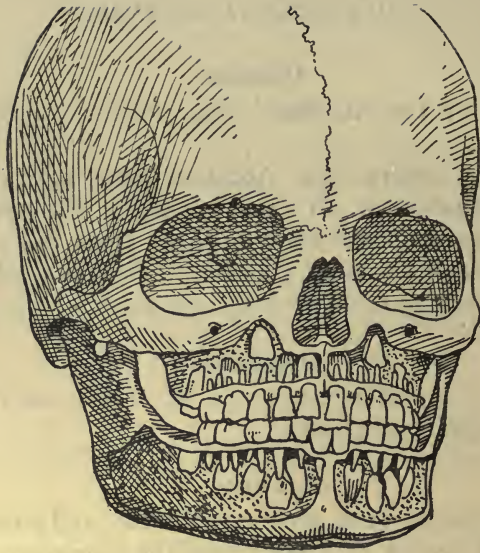


FIG. 176.—THE UPPER AND LOWER JAWS OF A CHILD ABOUT SEVEN YEARS OF AGE, WITH THE FRONT LAYER OF BONE REMOVED, SHOWING THE MAJORITY OF THE TEMPORARY TEETH ALREADY CUT, AND A NUMBER OF THE PERMANENT TEETH STILL BURIED IN THE BONES OF THE UPPER AND LOWER JAWS, READY IN TIME TO APPEAR, OR "BE CUT."

(From Buchanan's "Anatomy.")

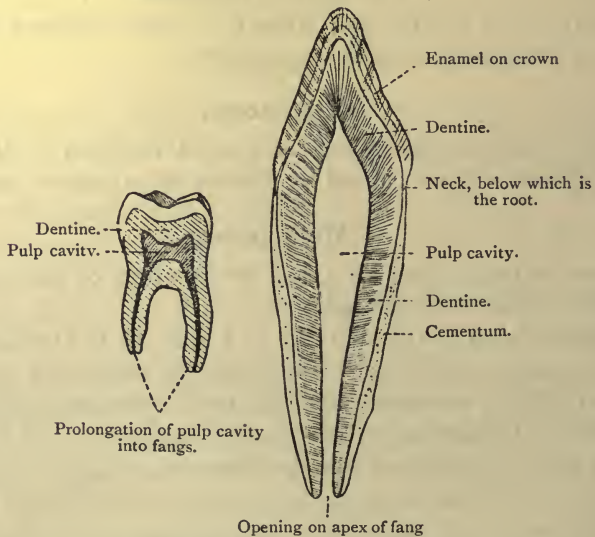


FIG. 177.—SECTIONS OF THE INCISOR TOOTH (ENLARGED) AND OF A MOLAR TOOTH, TO SHOW THE SEPARATE PARTS.

(From Buchanan's "Anatomy.")



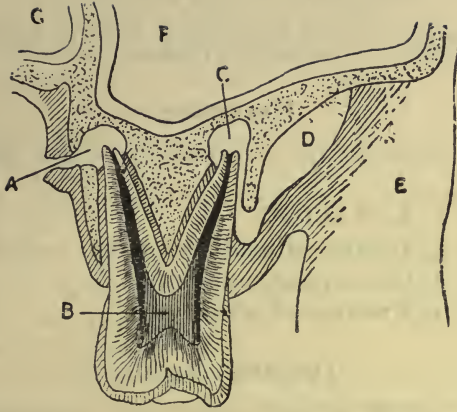


FIG. 178.—A SECTION THROUGH THE LEFT SIDE OF THE FACE THROUGH A DECAYED MOLAR TOOTH, WHICH IS INFLAMED AND HAS TWO ABSCESSSES AT ITS TWO FANGS.

B, the pulp-chamber inside the tooth, which contained septic material ("matter," or pus) from the germs passed down into the root of the tooth and set up as abscesses at A and C. C is an abscess at the root of the tooth, spreading on to the inside of the cheek to D; E, the cheek; F, the lower part of the large cheek sinus—the antrum; G, the nose. A is an abscess bursting through the bone socket into the mouth.

# ACCIDENTS TO TEETH AND JAWS.

BY NORMAN G. BENNETT,

M.B., B.C. (CANTAB.), L.D.S. (ENG.),

Dental Surgeon to St. George's Hospital and to the Royal Dental Hospital of London.

## Head-note.

THE serious consequences of accidents to the teeth and jaws are—

1. Loss of teeth.
2. Inflammation of the mouth and abscess.
3. Consequent indigestion.
4. Fracture of jaws.

## Technical Terms.

*Antrum*.—A hollow air-space within the cheek-bone. It communicates with the nose. (See Nose.) [Figs. 146, 178.]

*Abscess*.—A collection of pus or matter, covered by the skin or other tissue. For an abscess at the root of a tooth, see A, C, D of Fig. 178.

*Alveolus*.—That portion of the bone of either jaw which surrounds the roots of the teeth.

*Crowning*.—The adaptation of an artificial tooth of gold or porcelain to the natural root of a tooth.

*Crown*.—The part of the tooth above the gum. [Fig. 177.]

*Cementum*.—A thin layer of bone-like substance covering the dentine of the root. [Fig. 177.]

*Dental Caries*.—Gradual destruction by decay of tooth substance, caused by solution of the earthy parts (lime salts) and decomposition of the teeth.

*Dentine*.—The hard, ivory-like substance of the tooth, which encloses a soft tissue called the "pulp" or "nerve." The dentine of the crown is encased in a very hard, insensitive substance called "enamel." [Fig. 177.]

*Enamel*.—See Dentine. [Fig. 177.]

*False Joint*.—A movable joint formed between the two fractured portions of a bone by the development of a fibrous envelope embracing their broken ends.

*Fibrous Union.*—The union of the two fractured portions of bone by fibrous tissue instead of by new bone. (See above, False Joint.)

*Fistula.*—A channel caused by an accident or disease, and connecting two hollow organs, or an organ (or gland) with the external surface, and for a long time remaining open and discharging.

*Inferior Dental Nerves.*—The two nerves which supply the teeth of the lower jaw. Each nerve enters the bone on the inner side of the back of the lower jaw, and runs in a canal in the body of the bone, emerging again on the outside near the front of the jaw.

*Necrosis of the Bone.*—The death of a portion of bone caused by inflammation and interference with its blood-supply, so that the bone dies from lack of nutrition. [Figs. 21, 22, 23.]

*Périodontal Membrane.*—The intervening membrane that attaches the tooth to the bone (the alveolus) of the jaw.

*Pulp.*—The soft tissue or “nerve” inside the tooth; it is continuous, through the end of the root, with the bloodvessels and nerves of the surrounding parts. [Fig. 177.]

*Root.*—The part of the tooth below the gum, and surrounded by bone. [Fig. 177.]

*Salivary Fistula.*—An abnormal channel connecting a salivary gland with an opening on the face. (See above, Fistula.)

*Septic Infection.*—The introduction into the tissues or blood of certain bacteria or their products.

*Sinus.*—An unhealthy channel connecting an abscess with the external surface. It is caused by the discharge of matter (pus), and subsequent delay in healing. A sinus communicating between two hollow organs, or between a hollow organ (or gland) and the skin, is called a “fistula.” (See above, Fistula.)

*Salivary Glands.*—The salivary glands, six in number, supply the mouth with saliva. They are situated in close proximity to the jaws, and the saliva which they secrete is conveyed to the mouth by means of small ducts. These glands are situated thus: one each side outside the lower jaw, in front of the ear (the parotid glands); one each side below the lower jaw (the submaxillary glands); one each side of the tongue just behind the lower front teeth (the sublingual glands). [Fig. 2.]

### Anatomy.

The teeth are thirty-two in number, and the parts of a tooth are described above in the “Technical Terms” under the headings, “Crown, Cementum, Dentine, Pulp, and Root,” and are seen in Figs. 176, 177, 178. The nerve and blood supply to the pulp of the teeth enters through a small aperture at the end of each root. The roots of the teeth are separated from the bony alveolus, in which they are embedded, by a thin

membrane—the periodontal membrane, which is richly supplied with bloodvessels for the nourishment of the outside of the root.

### Consequences of Accident.

Accidents to the teeth are caused by direct or indirect violence—*e.g.*, a blow, a kick, or a shot, on the teeth, a blow or kick on the chin; or a fall on the heels causing impact against opposing teeth.

- (i.) Concussion of teeth.
- (ii.) Dislocation of teeth.
- (iii.) Fracture of teeth.
- (iv.) Displacement of artificial teeth.
- (v.) Fracture of lower jaw.
- (vi.) Fracture of upper jaw.
- (vii.) Dislocation of lower jaw.

(i.) **Concussion.**—Concussion leads to inflammation of the pulp of the tooth and of the periodontal membrane or sheath of the root. The pulp of the tooth is likely to die, and then, if it becomes infected by putrefactive germs conveyed by the blood, it will decompose, and probably cause an abscess at the root of the tooth. This abscess may find an outlet on the face, and cause a sinus and permanent scar, or in the case of certain upper teeth it may burst into the air-space within the cheek-bone (the antrum). [Fig. 178.] In rare cases an abscess in connection with a tooth may cause death from inflammation in the neck, or from infection of the membranes of the brain, or from the matter finding its way down into the chest. The looseness of a tooth caused by concussion is usually only temporary if an abscess does not occur.

(ii.) **Dislocation.**—Dislocation of a tooth usually involves the loss of the tooth unless it is replaced within a few hours and properly treated.

(iii.) **Fracture.**—Fracture of a tooth involves a train of results similar to those caused by concussion. If the pulp of the tooth is opened by the fracture, infection by germs and death of the pulp is almost certain to happen.

If several teeth are fractured, mastication and the general health may be affected, and in the case of front teeth the injury may be of æsthetic importance.

(iv.) **Displacement of Artificial Teeth.**—Small artificial dentures may become displaced during sleep or when diving into water, and may lodge in the larynx or gullet, or be

swallowed and remain in the stomach or intestine. Serious or dangerous consequences may ensue from the accident. (See Throat, p. 799.)

(v.) **Fracture of the Lower Jaw.**—The fracture is usually what is called “compound”—that is to say, the soft parts are so damaged that the fractured bone is in direct communication with the surface, and is thus liable to infection by germs. The most common complications are wounds of the face and lips, hæmorrhage, injury to the teeth, and less frequently injury to the base of the skull.

Later on death of a portion of bone, abscess, salivary fistula, or general blood-poisoning, may ensue. Paralysis or neuralgia may rarely occur from injury to one of the inferior dental nerves. Union is generally good, and the displacement slight if properly treated; but in some cases false-joint or fibrous union occurs.

(vi.) **Fracture of the Upper Jaw.**—Like the lower, fracture of the upper jaw is usually compound. The common complications are similar, but bleeding may be severe. The fracture may open up the antrum (air-space within the cheek-bone), or it may pass through to the inner parts of the nose, or be associated with fracture of any of the adjacent bones. Union is almost always good.

(vii.) **Dislocation of the Lower Jaw.**—Dislocation of the lower jaw is commonly caused by kicks or blows. It is easily reduced, and is usually of little consequence.

#### Disease.

(a) Actinomycosis is a disease which may affect the jaws through a broken or hollow tooth, and is characterized by formation of large quantities of pus or matter, and by exposure and death of bone. It is caused by the entrance into the tissues of a specific fungus, and is said to result most frequently from chewing raw food of a nature likely to injure the mucous membrane, such as corn.

(b) Inflammation of the bone-sheath (periostitis), an abscess in the antrum, or the separation of a piece of dead bone, are all diseases which may arise after injury to the teeth and jaws. (See Bones—Periostitis, p. 151.)

#### Return to Work.

The treatment of injured teeth may take several weeks, but the patient would be fit for work after the first day or two.

Repair of a fractured jaw takes several weeks, but in uncomplicated cases the patient would be fit for light employment after a week or less, but would not be fit for heavy employment under ten days to a fortnight. Complications such as septic fever (blood-poisoning), or neuralgia, or necrosis of the bone, may cause incapacity for much longer periods. Ununited fractures, such as fibrous union, or false joint, involve permanent damage to the masticatory functions which is only partly remediable.

#### Recurrence.

Recurrence is only likely in the case of dislocation of the lower jaw, and is of minor importance.

#### Occupation Disease.

Any occupation which causes acidity of the mouth directly, or indirectly, by the fermentation of starch or sugar, increases the liability to decay of teeth. Examples of those so employed are alkali workers, bakers, and millers.

Severe inflammation of the mucous membrane of the mouth, leading to loss of teeth and death of bone, is produced in those exposed to mercury, such as looking-glass workers. A special kind of necrosis of the jaws is produced in workers in yellow phosphorus. The chief importance of this is in connection with match factories. The disease is a serious one, but only affects workers with already diseased teeth or gums.

The poison usually obtains entrance through teeth so far decayed as to have a decomposed and septic pulp.

Proper care of the teeth and the mouth would prevent the disease. Red or amorphous phosphorus is quite harmless. Workers affected by syphilis, or the subjects of alcoholism, are said to be especially liable to phosphorus-poisoning.

#### Diagnosis.

Direct injuries to the teeth are hardly liable to be mistaken for *other* injuries. (See Poisons—Phosphorus, p. 639; Mercury, p. 634.)

#### Malingering.

Dislocation of the mandible originally caused by accident is sometimes intentionally reproduced by neurotic people, or by those wishing to make capital out of their affection.

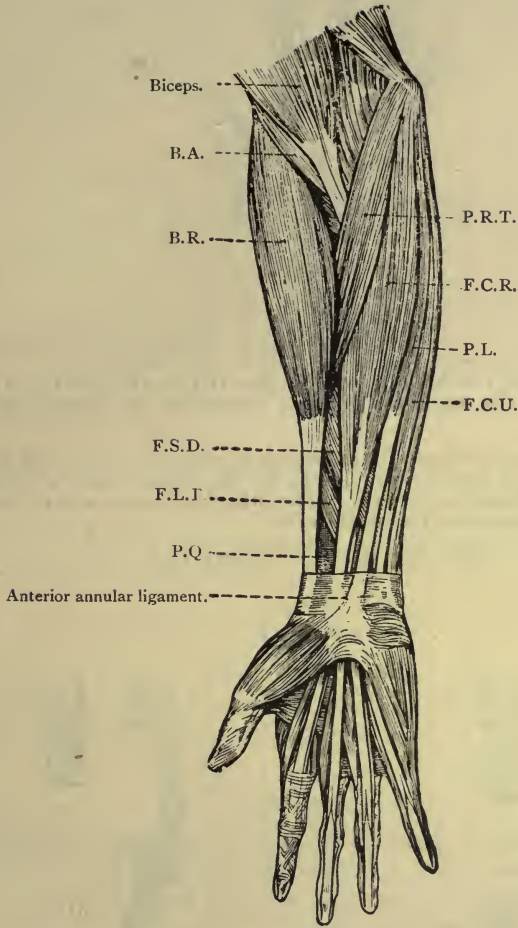


FIG. 179.—SUPERFICIAL MUSCLES OF THE FOREARM, SHOWING THEIR TENDONS PASSING UNDER THE BAND WHICH HOLDS THEM IN POSITION AT THE WRISTS. THIS BAND IS CALLED THE ANTERIOR ANNULAR LIGAMENT.

The firm sheath which encases the fingers is shown round the first finger. This sheath is removed from the other fingers, and the deeper tendons which are attached to the tips of the fingers are seen passing through the more superficial tendons, which are split to allow this. The letters refer to the particular muscles.

(From Buchanan's "Anatomy.")

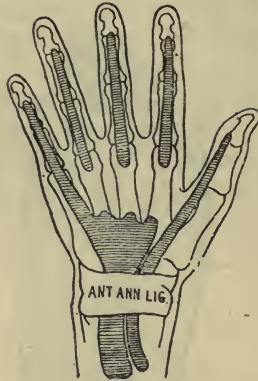


FIG. 180.—FRONT OF THE HAND, SHOWING IN A DIAGRAMMATIC MANNER THE SYNOVIAL SHEATHS WHICH IMMEDIATELY SURROUND THE TENDONS TO THE FINGERS.

The thumb has a separate sheath right through to above the wrist. The second, third, and fourth fingers have sheaths for the fingers which are separate from the large sheath at the wrist. The little finger has a sheath which is united to the large sheath under the wrist.

(From Rose and Carless's "Surgery.")



FIG. 181.—METHOD OF UNION OF TENDON AFTER LOSS OF SOME PART OF THE TENDON.

The flap is taken from one end only.

(From Rose and Carless's "Surgery.")



FIG. 182.—METHOD OF UNION OF TENDONS AFTER LOSS OF SOME PART OF THE TENDON.

The flap is taken from both ends.

(From Rose and Carless's "Surgery.")



# THE TENDONS.

By A. H. TUBBY,

M.S. (LOND.), F.R.C.S. (ENG.),

Surgeon to the Westminster Hospital and to the Royal National Orthopædic Hospital for the Deformed; Consulting Surgeon to the Evelina Hospital for Children;

AND

E. ROCK CARLING,

B.S. (LOND.), F.R.C.S. (ENG.),

Assistant-Surgeon to the Westminster Hospital; Senior Assistant-Surgeon to the Seamen's Hospital, Greenwich.

## Head-note.

Two results that are likely to arise in consequence of injury to tendons are: (1) Loss of movement; (2) spread of inflammation along the tendon-sheath.

## Technical Terms.

*Ganglion*.—A ganglion is a small rounded swelling containing a glairy fluid that forms on or in connection with a tendon-sheath. In some instances it is due to a pouching (hernia) of the thin membrane lining the fibrous sheath. It may occasionally follow injury or sprain, especially near the wrist or ankle, but in the majority of cases no definite relation to an injury can be found.

N.B.—This use of the word "ganglion" must be recognized as quite distinct from the sense in which it is employed by neurologists to describe special collections of nerve cells.

*Insertion (of a Tendon)*.—The place of attachment of a tendon to a bone. [Fig. 139.]

*Sheath (of a Tendon)*.—A glove-like sheath which surrounds a tendon or group of tendons. It is smooth and polished internally to allow the tendon free play, and is lubricated by the synovial fluid. [Figs. 179, 180.]

*Synovial Fluid*.—The fluid which is secreted by the lining of joints and tendon-sheaths; it acts as a lubricator to allow free movements.

*Tendon*.—A strong band of fibrous tissue by means of which the force of a muscular contraction is transmitted to the point of insertion of the muscle into a bone. [Figs. 139, 179.]

*Tēno-Synōvītis*.—Inflammation of the lining membrane of a tendon-sheath.

### Anatomy.

A tendon is a narrow band or string of fibrous tissue. It transmits the force of a muscular contraction to its destination. The end that is attached to the bone is more or less expanded, blending with the fibrous covering. The bone itself is rough and irregular at that point, so that the tendon is very firmly attached. Owing to their small size, the tendons are able to run in grooves in various bones, and round or across joints, to the strength of which they add considerably. Sometimes, as in the tendo Achillis, the tendons of more than one muscle unite to form one strong band; in other cases, as in the tendons to the fingers, one tendon may divide into several.

The tendons run in sheaths to a varying extent when they pass over joints. In one or two instances tendons pass round very sharp angles. In the case of one of the muscles of the eye there is a definite pulley, through which the tendon of the muscle passes so as to alter completely the direction of the force of the muscular contraction.

**Tendon Sheaths**.—Where the tendons cross the joints, the bones are often deeply grooved for their passage. The grooves are covered over by fibrous bands, so that the tendon is firmly bound against the bone and the joint, although allowed free play in the direction of pull. In addition to these fibrous tunnels there is a thinner covering called the "synovial sheath," which may extend the whole length of the tendon, and it contains the lubricating fluid. It is smooth and polished internally like the lining of a joint. The importance of this synovial sheath arises from the fact that when a tendon is injured, and inflammation is set up, the whole of the sheath may become inflamed.

The anatomical arrangements of the sheath are fairly regular, so that the probable extent of the inflammation can be estimated; but very frequently, and in some situations almost invariably, these tendon-sheaths communicate with other tendon-sheaths, or with the joints over which they pass. The serious consequences of this communication are of course obvious. A small punctured wound of a tendon and its sheath may lead to spreading inflammation, which extends not only within the limits

of a tendon-sheath, but to the neighbouring joints, which it may ultimately destroy. Inflammation of the sheath and its tendon is commonly accompanied by the pouring out of a considerable quantity of inflammatory fluid, which forms fibrous bands or adhesions. For this reason it is always necessary after inflammation to commence passive movements of the joint at an early period. By doing so adhesions may either be prevented from forming, or so stretched that they cause no harm. After fractures and injuries to a joint, a patient often complains of pains and stiffness on movements, which, though they may partly come from adhesions in the joint itself, in other cases arise from inflammation about the tendons.

### Consequences of Accident.

- (i.) Contusion (bruising).
- (ii.) Strain.
- (iii.) Laceration.
- (iv.) Rupture.
- (v.) Wound.
- (vi.) Dislocation.

(i.) **Contusion (Bruising).**—Where tendons run superficially, they may be injured by blows. Then effusion of blood and of inflammatory fluid makes them painful, hinders their movements, and often incapacitates the limb temporarily. Sometimes adhesions between the tendon and its sheath follow, and the disability is more prolonged.

(ii.) **Strain.**—For effects of strains, see below, Disease—Ganglion.

(iii.) **Laceration.**—In accidents, such as those caused by machinery, tendons may be severely lacerated, or even torn away.

(iv.) **Rupture** is generally due to ill-timed muscular actions. It occurs chiefly during the active periods of life, but in later middle life it is particularly prone to affect tendons already damaged or weakened by disease. The tendons most often affected are the tendo Achillis and the thin, ribbon-like plantaris tendon, which is deeply placed beneath it at the back of the leg; the patellar tendon (tendon to the kneecap); the tendon of the triceps muscle, which is attached to the point of the elbow. The tendo Achillis and plantaris are commonly broken by tennis-players and in jumping.

A curious deformity is sometimes seen in the fingers, known as "mallet" or "dropped" finger. It arises from a blow or fall

on the tip of the extended finger, and is due to the tearing away of the long extensor tendon from the bone at the end of the finger.

(v.) **Wounds of Tendons** are common accidents; they most frequently happen about the wrists from fragments of glass or from the slipping of a knife. Apart from inflammation (sepsis), wounds of tendons are so readily repaired that they do not often endanger the usefulness of the limb, if the cut ends are aseptically united by sutures. (See Children—Tendons, p. 234.)

#### Operation.

(i.) **Contusions.** (ii.) **Strains.**—Contusions and strains require no operation.

(iii.) **Lacerations.** (iv.) **Rupture.** (v.) **Wounds.**—Lacerated, ruptured, or cut tendons should be sutured at once. Where the ends of tendons cannot be approximated or have been destroyed, portions of collateral tendons or artificial ones may be used to restore continuity and function. Very extensive operations of this sort are sometimes undertaken; they require great care, patience, and prolonged after-treatment.

(vi.) **Dislocation.**—Dislocation of a tendon often calls for an operation for its cure. It may be enough to stitch up the ruptured sheath, but often a new groove must be formed in the bone or the old one deepened.

#### Cure.

(i.) **Contusions.** (ii.) **Strains.**—Contusions and strains are usually well in a few weeks.

(iii.) **Lacerations.** (iv.) **Rupture.** (v.) **Wounds.**—A tendon takes six weeks to heal entirely, but for the larger ones, such as the tendo Achillis (back of the heel), it is safer to allow two months.

(vi.) **Dislocation.**—See below, Return to Work.

#### Return to Work.

(i.) **Contusions.** (ii.) **Strains.**—As soon as surgical cure is complete.

(iii.) **Lacerations.** (iv.) **Rupture.** (v.) **Wounds.**—After union by suture—(a) Where healing has been simple without undue inflammation or sepsis—fourteen to fifty-six days. (b) Where inflammation (sepsis) has occurred—after several months.

(vi.) **Dislocation.**—(a) Non - operative — each case must be judged upon its merits. (b) Operative—six weeks.

#### Recurrence.

A tendon once dislocated is liable to displacement by comparatively slight violence; even by operation complete stability cannot always be guaranteed.

#### Occupation Diseases.

**Miner's Wrist.\***—All who use heavy implements or control heavy machinery, performing movements which are frequently repeated, are liable to inflammation of the sheaths of tendons—teno-synovitis. A good example of this occurs in "Miner's Wrist." (See Joints—Occupation Diseases, p. 500.)

\* A disease included in the third schedule of the Workmen's Compensation Act, 1906.

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*For legal cases of injury to Tendons, see CASE GUIDE : Tendons.*

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## TESTICLES AND TESTIS.

See GENITAL ORGANS—MALE.



FIG. 183.—TETANUS BACILLI, SHOWN SEMI-DIAGRAMMATICALLY.  
The inset shows the same highly magnified to show flagella.

# TETANUS (LOCKJAW).

By EDRED M. CORNER,

M.C., F.R.C.S.,

Surgeon to the Children's Hospital, Great Ormond Street ; Surgeon to the Surgical Infections Wards and to Out-Patients, St. Thomas's Hospital.

## Head-note.

TETANUS is the disease which results from infection of the body with the tetanus bacillus. It is characterized by the occurrence of fits with spasmodic closure of the jaws (trismus), and by spasms of the muscles of the back, and perhaps of the whole body (tetanus).

## Technical Terms.

*Acute Tětānus.*—The more severe forms of the disease.

*Ānaerōbē.*—Micro-organisms which can grow when air is excluded from them.

*Ānaerōbē, Obligatory.*—See Obligatory Anaerobes.

*Āntītētānic Serum.*—The serum obtained from the blood of an animal, usually a horse, which has been rendered incapable of being infected by the tetanus bacillus.

*Bācillūs.*—A microbe, micro-organism, or virus. Strictly speaking, it is limited to a rod-shaped micro-organism, as opposed to the round form (cocci).

*Cauterization.*—The destruction of tissues, and anything in or on them, by means of caustics—*e.g.*, caustic potash, nitric acid, red-hot needles, etc.

*Chronic Tětānus.*—The less severe form of the disease.

*Compound Fracture.*—A broken bone accompanied by a wound of the skin which communicates with the fracture.

*Fever.*—The normal temperature of the body is 98·4° F. When this is raised, the condition is called "fever."

*Hysteria.*—A morbid condition of the brain and mind which may lead to the simulation of almost any disease ; it resembles, but is not, malingering.

*Idiōpāthic Tetanus.*—Tetanus in which the causation of the disease

is said to have arisen from within the body without a wound (not generally believed to occur).

*Incubation Period.*—The time between the infection and that of the first appearance of the symptoms of the disease.

*Infection.*—The contamination of the body by micro-organisms.

*Immune.*—An animal is immune to a disease which it is incapable of acquiring. For instance, the horse supplying antitetanic serum has been made immune from tetanus.

*Obligatory Anaerobes.*—Micro-organisms which can only grow away from air.

*Ōpīsthōtōnos.*—The position when the muscles of the back and legs are so violently contracted that the body is raised, and the patient rests on his head and his heels.

*Serum.*—The liquid part of any blood left after the removal of the solids.

*Spores.*—Thick-skinned, rounded seeds produced by the micro-organism, which enable it to continue life under adverse conditions.

*Tēmpōrō-Māxillāry Joint.*—The joint between the lower jaw and the skull, situated just in front of the ear.

*Tētānus Nēōnātorum.*—The disease in the newly-born babe.

*Toxins.*—The name given to poisonous substances manufactured by bacilli and other organisms.

*Umbilical Cord.*—The cord from the mother to the navel of her baby, through which the latter is nourished and gets rid of its waste material. It is tied and divided at birth, after which a dressing is applied to the cut end, which soon heals up.

### Nature of Tetanus.

Tetanus is a disease characterized by violent contractions or spasms of the muscles. It occurs in all countries, but is particularly common in the tropics. Horses are peculiarly susceptible to tetanus, the bacilli being very frequently present in their solid excreta. Thus we find a greater number of cases occur among ostlers and those whose duties bring them much in contact with horses.

Earth or dung is the usual material from which infection occurs, as the bacillus is found in the soil down to a depth of 6 feet.

Tetanus has been known to occur in epidemics among newborn babies (tetanus neonatorum); it arises from dressing the cut end of the umbilical cord with earth.

Tetanus is caused by a micro-organism, the bacillus, which is often overlooked, as it is not easily grown outside the body. When grown artificially in the laboratory, it has to be cultivated in the absence of air, hydrogen or some other gas being usually



employed to take the place of air; hence it is called an "obligatory anaerobe."

The damage inflicted by the disease appears to be done, not so much by the increase in the number of the bacilli themselves, as by an active poison (toxin) which the bacilli produce in large quantities. It is believed that this poison is absorbed by the nerves and their vessels, being conveyed to the spinal cord and brain, on the cells of which it acts, producing the tetanic spasms.

It has been discovered that the cells of the nervous system have a special power of collecting this poison. Some tetanus poison (toxin) was injected into a chicken, and three minutes afterwards its head was cut off, when it was found that the whole of the tetanus poison was already collected in the brain and spinal cord.

The bacillus of tetanus is rod-shaped, and forms spores, which are developed at one or both ends, giving it a characteristic drumstick appearance. These spores are exceedingly difficult to destroy, being able to stand the effects of boiling for several minutes, and drying for several months, whilst they remain capable of germinating and giving the disease. They are found at the seat of the injury perhaps only during the earlier stages of the disease. [Fig. 182.]

The incubation period varies. The first symptoms of the disease appear from four to fourteen days after the infection of the bacillus.

A form of the disease is described as "idiopathic tetanus," which means tetanus arising without any wound; but modern opinion is clear that some wound, however small, is present in all cases, and through it the bacilli gain entrance to the body.

Sometimes tetanus follows upon a severe injury, such as compound fracture, and at other times follows a trivial injury, such as a bee-sting. All that is necessary is a wound that is large enough to admit the tetanus bacillus. The disease is particularly apt to follow injuries to the hands and feet, where dirt is constantly appearing. Occasionally the wound which is infected with the tetanus bacillus may heal completely before any symptoms of the disease have manifested themselves.

### Consequences of Infection.

The course of the disease is roughly as follows: Between the third to the fourteenth day after the accident, the patient com-

plains most frequently of stiffness of the back of the neck, usually attributed to a draught; this is often followed by difficulty in swallowing. Fever is usually absent. Violent spasms occur, and profuse sweating takes place during the spasms; the pain is agonizing (like very severe cramp), the patient being unable to utter a word. After a few minutes the paroxysm passes off, only to be renewed by the slightest stimulus. A draught of air, a noise, an attempt to swallow, or touching the patient, may be sufficient to bring on another spasm. These spasms start in the muscles of the jaws, and quickly extend to the muscles of the trunk and limbs, causing the body to be contorted in various directions; often it rests on the head and heels, with raised arched back (opisthotonos). The intellect usually remains clear to the end. Death will take place generally, in fatal cases, from one to four days after the onset of the first symptoms.

The above symptoms constitute what may be called "acute tetanus." There is, however, a chronic form of the disease. This form has a longer incubation period, and is less severe, often ending in recovery. The contraction of muscles may be localized to one part of the body, sometimes to those parts near the site of infection only; but the general spasm of the muscles of the whole body is absent.

There is a variety of tetanus called "head" (cephalic) tetanus, which sometimes follows injuries to the parts of the head and neck. It is distinguished by the contraction of the muscles of mastication (trismus), combined with spasm of the muscles of the throat and paralysis of the face. Formerly another variety of the disease was recognized, in which it was impossible to ascertain any possible wound or site of infection. It was called "idiopathic tetanus." As it is now known that the wound by which the infection gained admission to the body may have disappeared long before any symptoms of tetanus may have appeared, idiopathic disease is no longer believed in.

### Disease.

1. **Caused by the Accident.**—The injection of tetanus antitoxin is sometimes followed by unpleasant consequences—rashes, etc. (See Skin, Rashes, etc., p. 729.)

2. **Existing before the Accident and aggravating its Effects.**—There is nothing special to note in this respect. Tetanus is so violent a disease that it overshadows all other maladies that might be present before its onset.

### Operation.

If the disease has once established itself, thorough excision of the wound should be undertaken, followed by cauterization. Amputation of part of the limb may be found necessary, but the disease will probably run its course in spite of all the local treatment. By such means the local production of the tetanus toxins (by the bacilli) is removed. The patient is to be kept absolutely quiet in a back room, chloral and similar drugs being used, and chloroform administered if necessary to relieve the spasms.

Serum treatment has been found valuable in some cases. This consists, usually, in the injection into the body of large doses of an antitetanic serum prepared from the serum of an animal which has previously been rendered immune.

### Cure.

The outlook is distinctly unfavourable. Cases of acute tetanus almost always end fatally, whilst in the chronic form the chances are more favourable.

It has been shown that if the incubation period is longer, a greater percentage of cases recover than is the case where the incubation period is less than nine days.

With regard to the duration of the disease, fatal cases usually die within a week; non-fatal cases take on the average two to six months to recover. The recovery is complete as regards the patient's capabilities for mental or physical work, but is frequently retarded by neurasthenia.

### Return to Work.

No exact period can be given at the end of which a man can return to work. Each case must be considered on its own merits; but when surgical cure is complete, and neurasthenia overcome, the man may resume his work. The subsequent neurasthenia is not usually severe.

### Recurrence.

There is no risk of recurrence.

### Diagnosis.

This is rarely difficult. In the very early stages it must be distinguished from spasm of the jaw due to disease of the temporo-maxillary joint, the joint between the jaws, or to the irritation of an inflamed tooth. The condition at all frequent

and likely to be confused with tetanus is strychnine-poisoning. In strychnine-poisoning the onset is much more sudden, and the history of the case, the absence of any wound (it must be remembered, however, that tetanus may occur from a very insignificant wound, or after the wound has healed), and the rapid and violent spasms, ought to prevent any error in diagnosis. The hands are often involved in strychnine spasms, the muscles completely relaxing between each attack, and the muscles of the jaw are usually unaffected.

Trismus, closure of the jaws due to the irritation of a carious tooth, and hysteria, are so easily distinguished from tetanus that they only need mention.

### Malingering.

It is practically impossible for anyone to simulate this disease sufficiently well to deceive well-informed people, even though it is recognized that the actual cause, the tetanus bacillus, cannot always be discovered.

Hysterical fits are quite different, being more noisy, much longer, accompanied by screaming, purposive movements, etc. The majority of cases of lockjaw, so called, are due to the irritation of a decayed tooth.

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*For legal cases of Tetanus, see CASE GUIDE: Tetanus.*

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## THORACIC DUCT.

See VESSELS—LYMPHATICS.

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## THORAX.

See HEART, LUNGS.

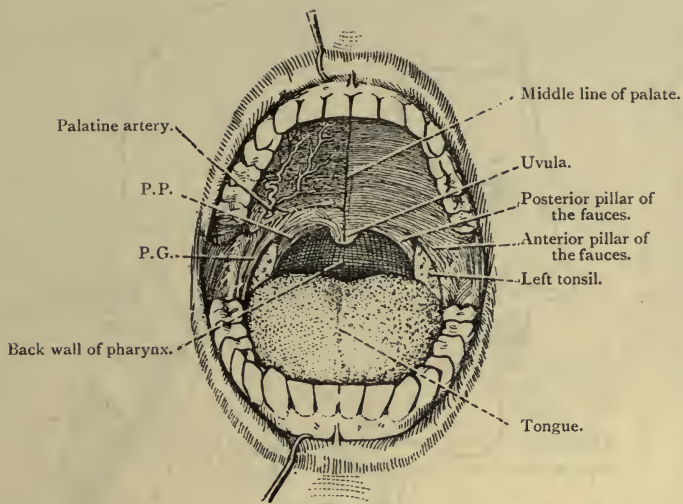


FIG. 184.—OPEN MOUTH, SHOWING THE BACK OF THE THROAT, OR PHARYNX, THE PALATE, AND TONSILS, ETC.

On the right side of the palate, the lining of the mouth, the mucous membrane, has been removed, showing the muscles and artery of the palate. P.P. and P.G. are muscles of the palate. (From Buchanan's "Anatomy.")

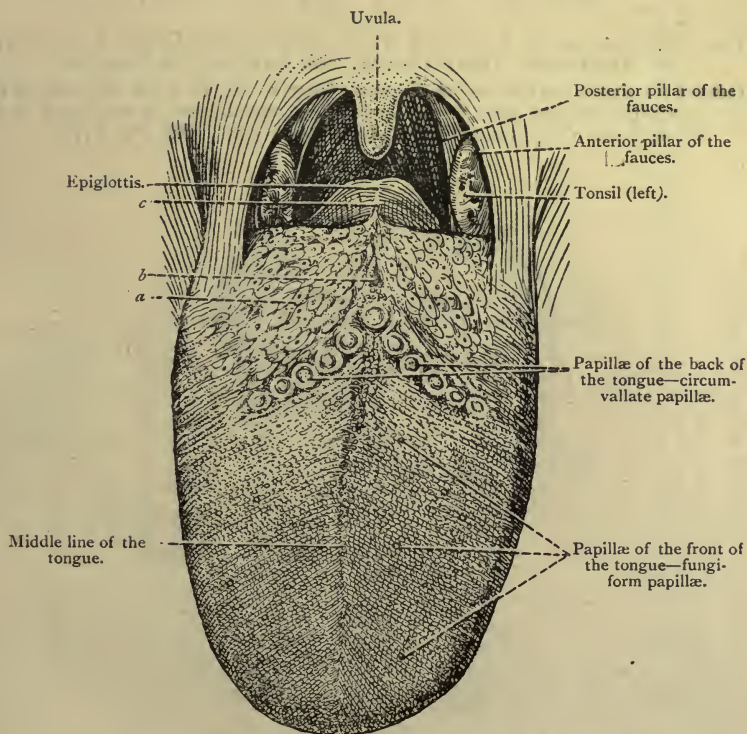


FIG. 185.—THE TONGUE AND PARTS BEHIND AND NEAR IT. The letters *a* to *c* indicate named parts. (From Buchanan's "Anatomy.")

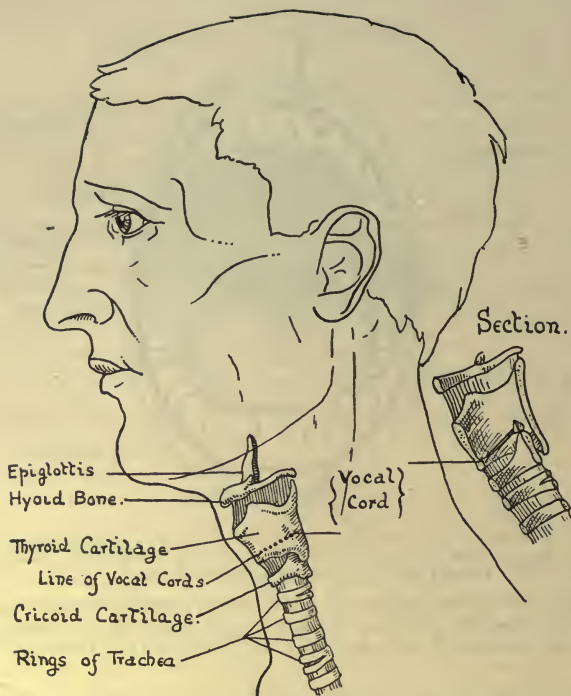


FIG. 186.—PROFILE OF FACE AND NECK, SHOWING THE UPPER PART OF THE WINDPIPE AND VOCAL ORGANS, THE LARYNX AND TRACHEA.

Behind the figure is a section of the same larynx, cut, to show one half of the windpipe and the right vocal cord. The œsophagus, or food-pipe, is not shown here, it lies immediately behind the larynx. (See Fig. 147.)

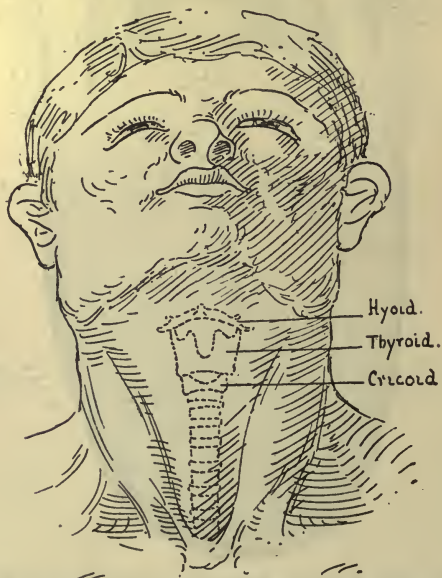


FIG. 187.—PROJECTION OF THE WINDPIPE AND LARYNX, SEEN FROM THE FRONT, THE HEAD BEING THROWN BACK.

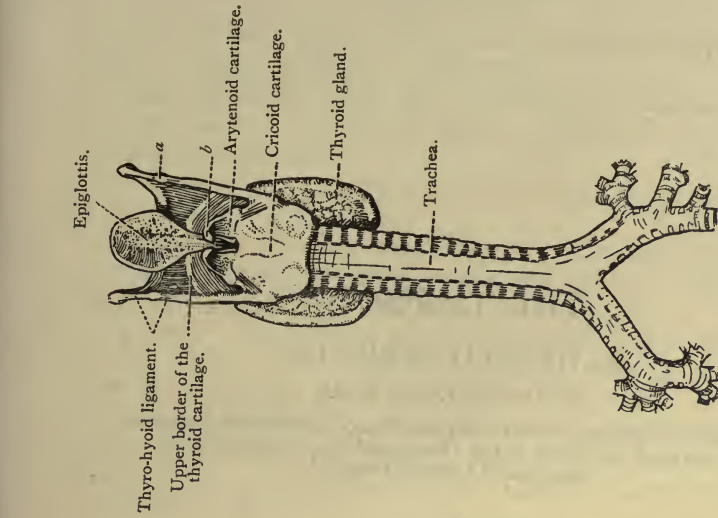


FIG. 189.—FIG. 188 AS SEEN FROM BEHIND.

Notice the cricoid cartilage is a complete ring, seen in front and behind, being larger behind. The thyroid cartilage is open behind and chiefly seen from the front. (See Fig. 186.)

(From Buchanan's "Anatomy.")

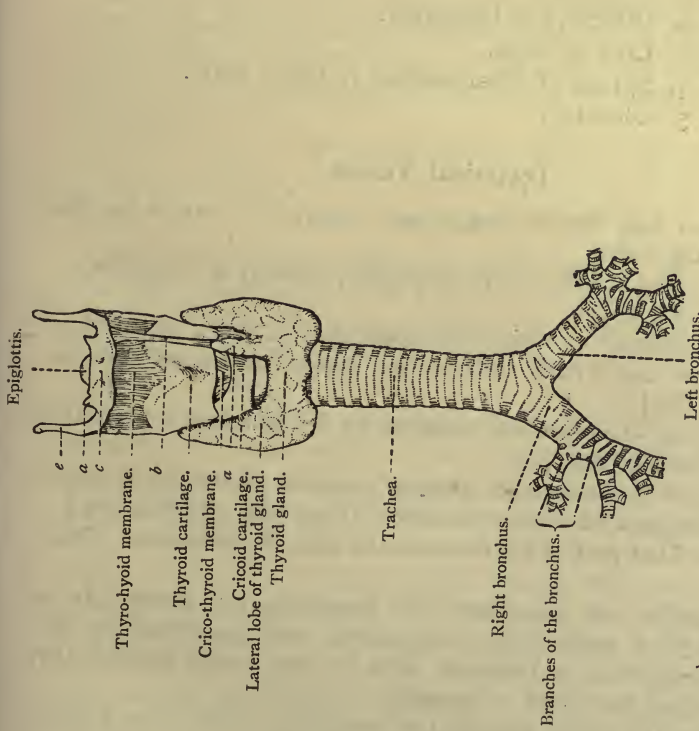


FIG. 188.—THE LARYNX, TRACHEA, AND BRONCHI (BRANCHING INTO THE LUNGS), REMOVED FROM THE BODY, WITH THE THYROID GLAND REMAINING ATTACHED ACROSS THE TRACHEA.

*a* and *b* are parts relating to the thyroid gland; *c*, *d*, *e*, are parts of the hyoid bone.

(From Buchanan's "Anatomy.")

# THE THROAT.

BY HAROLD BARWELL,

M.B. (LOND.), F.R.C.S. (ENG.),

Surgeon for Diseases of the Throat and Nose, St. George's Hospital ;  
Surgeon in Charge of the Throat and Ear Department,  
Hampstead General Hospital.

## Head-note.

INJURIES to the throat (larynx) lead to five serious consequences :

1. Suffocation.
2. Difficulty in breathing.
3. Loss of voice.
4. Spread of inflammation to other parts.
5. Bleeding.

## Technical Terms.

*Bougîe*.—A long flexible rod of soft material for examining the interior of the body.

*Brönchi*.—The branches of the windpipe; the seat of "bronchitis." [Figs. 148, 188, 189.]

*Cricoid Cartilage*.—A ring of cartilage shaped like a signet ring, placed below the thyroid cartilage and supporting the vocal cords. [Figs. 186-189.]

*Ĕmphysemă*.—The swelling produced by the escape of air into the solid substance of the body.

*Ĕpiglōttis*.—A leaf-shaped cartilage attached to the back of the tongue, forming a lid to the windpipe. [Figs. 185, 186, 188, 189.]

*Faucēs*.—That part of the throat at the back of the mouth. [Fig. 184.]

*Lăryngōscōpe*.—An instrument for examining the throat. It is composed of a small mirror introduced into the throat by the examiner, on which a reflected light is cast, which enables the deeper parts of the throat to be seen.

*Lărynx*.—The upper part of the windpipe, which forms a box, open above and below, containing the vocal cords. The sides are



formed by the thyroid cartilage above and the cricoid cartilage below. [Figs. 148, 186, 187, 188, 189.]

*Mucous Membrane.*—The soft skin lining the interior surfaces of the body that are accessible to the air. It lines the mouth, pharynx, trachea, bronchi, etc.

*Œsophagus.*—The gullet or food pipe from the back of the throat to the stomach. [Fig. 148.]

*Palate.*—The partition which separates the nose from the mouth. In front it is bony, and called the “hard palate”; behind it hangs down, as a curtain, the “soft palate.” [Fig. 184.]

*Pharynx.*—The common passage for air and food at the upper part of the throat. It communicates with the nose and mouth above, with the œsophagus and larynx below. [Fig. 148.]

*Pröbäng.*—A long slender tube which is employed to remove small bodies from the throat. By a mechanical contrivance it broadens out at its end when being withdrawn from the throat.

*Stricture.*—Narrowing.

*Thyroid Cartilage.*—A shield of cartilage shaped like a **V**, with the point forwards, covering the vocal cords and forming the “Adam’s apple.” [Figs. 186-189.]

*Trächää.*—The windpipe from below the larynx down to the place where it divides into a branch for each lung (the two bronchi).

*Trächöötömy.*—The operation of cutting open the trachea; usually followed by the introduction of a breathing-tube (tracheotomy-tube) into the hole.

*Ůvülä.*—A small fleshy pendant which hangs from the soft palate. [Figs. 184, 185.]

### Anatomy.

The throat includes the back of the mouth, the palate, with the uvula hanging from it, and on each side of the throat the tonsils, lying between two folds of skin which are called the “anterior” and “posterior” “pillars of the fauces.” [Figs. 184, 185.] Behind all these is the upper part of the throat (the pharynx), which communicates above with the nose and mouth, and below with the two tubes known as the “wind-pipe” (larynx) and the “food-pipe” (œsophagus). The upper part of the windpipe is in the form of a box, containing the voice organs. Across it are stretched the two vocal cords, the vibrations of which produce the sounds used in singing and speaking. Attached to the root of the tongue, hanging over the larynx, is a leaf-shaped cartilage (the epiglottis), which may be loosely described as the lid of the windpipe. The vocal cords are hidden behind the “Adam’s apple,” the lump in the throat made by a **V**-shaped shield of cartilage (the

thyroid cartilage); to the lower end of this is hinged another ring of cartilage (the cricoid). [Figs. 148, 186-189.]

Below the larynx the windpipe (trachea) continues until it branches into the two tubes (bronchi) which end in the lungs. The food-pipe (œsophagus) begins above in the pharynx, at the level of the "Adam's apple," and ends in the stomach. [Figs. 148, 172.]

### Consequences of Accident.

(i.) Scalds and burns to (a) mouth, (b) food-pipe, (c) windpipe.

(ii.) Foreign bodies in (a) mouth, (b) food-pipe, (c) windpipe.

(iii.) Contusions or wounds to (a) mouth, (b) food-pipe, (c) windpipe. (For cut-throat, see Suicidal Wounds.)

(i.) **Scalds and Burns.**—These may be caused by hot or corrosive liquids, swallowed or inhaled steam, and cause injuries to the—

(a) *Mouth.*—As the real danger lies in injury to the windpipe and food-pipe, the consequences will be discussed below.

The only serious consequences as regards the mouth arise from inability to take food while the mouth remains sore. The signs of these injuries are always visible within the mouth, the lining skin being red and swollen, or more often white and corrugated. In the case of the very strong acids it may be coloured or black.

(b) *Food-pipe.*—The pain of such injuries will be very great, and accompanied by rapid swelling and inability to swallow. There may be the most extensive ulceration throughout the whole length of the food-pipe; all the lining skin (mucous membrane) may be stripped off by poisons such as sulphuric acid; and the consequences even from shock alone may be most serious.

(c) *Windpipe.*—Scalds and burns most commonly occur in young children of the lower classes, while attempting to drink from spouts of kettles. They occur in adults from swallowing hot liquids, or from the inhalation of steam in explosions or by boiler accidents.

Corrosive liquids swallowed suicidally or by accident may be sucked into the windpipe. The effects are much the same as burns by steam or hot water, except that they are usually more severe and less curable.

The immediate effects are pain in the throat and very severe shock, soon succeeded by a difficulty in breathing, caused by

swelling of the throat and windpipe. This may be so rapid and extensive that the man may die almost immediately from suffocation, and to prevent this the windpipe may have to be opened to enable him to breathe. Ulceration is likely to occur and to be slow in healing, leaving scars, which by contracting may either narrow or completely close the windpipe.

(ii.) **Foreign Bodies.**—Foreign bodies may be either large—*e.g.*, a mass of food closing the whole of the back of the throat; or they may be small—*e.g.*, a pin, which may slip between the vocal cords down into the lungs. The accident may cause violent struggling for breath, and coughing, with all the symptoms of intense suffering, or, on the other hand, the man may drop down and die without a struggle. An operation which may be of a serious nature may be required to remove any of these foreign bodies.

Suicidal and homicidal introduction of substances into the food and air passages are by no means uncommon, and will be discussed below.

(a) *Mouth.*—A mass of sufficient size, such as a large bolus of food, may become impacted in the pharynx at the back of the mouth and above the opening of the larynx, and rapidly cause death by suffocation.

(b) *Food-pipe.*—This is not uncommon. False teeth, lumps of food, fish-bones, and pins, have all caused death through becoming lodged in the food-pipe. If the article is not removed, it either causes very great difficulty in swallowing or entirely closes the passage.

A small foreign body like a pin may remain in the food-pipe without preventing swallowing, but will subsequently cause inflammation. Matter may collect round it, forming an abscess which may spread and produce very serious results.

(c) *Windpipe (Larynx and Trachea).*—This also may be blocked by large lumps of food which entirely occlude the air-passage, or minute bodies, such as a pin, or even liquids, which may be inhaled into the lungs. The dangers from these accidents are of four kinds: the first, sudden death through inability to breathe by the passages being blocked; the second, sudden death from closure of the vocal cords, due to the irritation of the foreign body (this is called "spasm of the glottis"); the third danger is from inflammation of the lungs; the fourth, from inflammation at the place where the body is fixed, and which may lead to abscess, or later to narrowing of the windpipe.

Laughing, vomiting, or coughing may be the cause of the entering of the foreign body. Food vomited is particularly liable to enter the air-passages of a man in the state of intoxication, as his condition renders him less sensitive to irritation.

(iii.) **Wounds.**—(a) *The Mouth.*—A sharp substance may enter the mouth and cause injury. The immediate danger is bleeding from one of the large vessels which lie near the tonsils. Injury to any one of these may be very rapidly fatal; such injury could occur through a pipe-stem driven into the mouth by falling.

Injuries to the lips and teeth need no special description here. (See Teeth.)

(b) *Food-pipe.*—The food-pipe is very rarely injured by cuts, stabs, or bruises, unless the windpipe is injured at the same time.

(c) *Windpipe.*—Bruises of the windpipe may occur from direct blows, violence, throttling, and strangulation. Even if the cartilages are not broken, the injury may cause cough and pain in the throat, loss of voice, and considerable shock.

If the cartilages of the larynx are broken (thyroid and cricoid) the results are much more serious.

A blow or compression will break the cartilages, and a fall on a hard body, such as the edge of a table, has been said to have broken them; but this is disputed by some authorities. These fractures are more common after the age of forty years, for from this age the cartilages gradually become bone, which is more brittle.

The break is sometimes star-shaped from a blow, but it is usually lengthways, especially in the case of throttling. In any case considerable violence is necessary to cause a fracture. The result of fracture of the large V-shaped cartilage (the thyroid) varies much. It forms the principal part of the "Adam's apple," and is most often broken.

Slight cases may possibly pass unnoticed, but usually there is intense shock, which is said to have been fatal.

The symptoms of breaking of these cartilages are hoarseness or complete loss of voice, and pain in swallowing and speaking. Blood may run down the air-passages, and may be coughed up after the accident. There is usually severe shock, which may prove fatal. If, as often happens, the lining mucous membrane of the windpipe be torn, and the broken ends of the cartilages exposed, air may enter the wound and penetrate into the parts round the throat, causing swelling to a greater or less degree

(emphysema). When the cartilages are broken and exposed to the air, inflammation is very likely to occur. Matter forms and collects round the cartilage, which may die and be cast off after a prolonged illness. Much deformity and narrowing of the windpipe will result, or death may be caused by blood-poisoning or by inflammation of the lungs.

### Disease.

1. **Caused by the Accident.**—Apart from inflammation, which may follow any injury to the body, the special results of the injury to the throat are impairment or loss of voice, which may be temporary or permanent, and narrowing of the foodpipe or windpipe.

Where the windpipe or any part of it is injured, air may escape into the tissues round the neck (emphysema), which may lead, as has been mentioned above, to the formation of an abscess. The formation of matter, should it lead to destruction of some of the cartilages, causes a long and very painful illness with great exhaustion, by the dead parts slowly separating, and the passages gradually becoming narrow from the contraction of the scars.

If the injury be high up in the back of the throat, the resulting inflammation may spread to the Eustachian tubes. This will obstruct the free entry of air to the ear, where it is so important to keep the pressure equal on each side of the drum skin, and cause deafness. Or the inflammation may spread and produce an abscess in the ear. (See Ear, p. 250.)

**Disease after Cut-Throat.**—See below, Criminal Wounds. Apart from the cutting of the great vessels, the most serious danger is the risk of blood or matter running down the windpipe. This blood is freely exposed to the air, and is one of the foods most favourable to the multiplication of the bacilli of decomposition which are present in the air. Pneumonia may be set up, or an abscess may form in the lungs, either being the forerunner of an illness that is frequently fatal.

2. **Existing before the Accident and aggravating its Effects.**—(a) The throat is frequently the seat of some disease.

(b) Any old inflammation in the throat may aggravate the effects of an accident, by making the healing slower and the bleeding more severe.

(c) The mouth and tonsils suffer from various inflammations, which would aggravate the effects of injury to these parts.

(d) Tuberculosis or syphilitic disease of the throat may be

at once stirred into fresh activity by an injury. The inflammation following even slight injury to the throat may revive disease of the ears, which at the time of the injury was dormant or nearly cured. (See Ear, p. 250.)

(e) Bronchitis and tuberculosis of the lungs are readily stirred into greater activity by an injury to the air-passages.

### Operation.

(i.) **Scalds and Burns.**—To avoid suffocation it is often necessary to open the windpipe (tracheotomy). The operation is not in itself serious, but the failure to perform it in time may be most dangerous.

Serious and repeated operations may be required to treat contractions after burns and scars. If the throat be so narrowed as to prevent the swallowing of sufficient food, it may be necessary to make an opening in the stomach, through which the man can be artificially fed. This is a serious operation, and leaves the patient a permanent invalid.

(ii.) **Foreign Bodies.**—Foreign bodies must be removed, and removed immediately. If they remain they will cause death, either from suffocation or inflammation; but if they are removed early the results are exceedingly good. The operation may be as simple as merely removing the object with the finger or forceps or probang (see above, Technical Terms), or it may be so serious as to necessitate the opening of the windpipe or larynx. Some risk is attached to these operations, and permanent hoarseness may result from opening the larynx.

Where a foreign body has gone through the vocal cords into the tubes (the bronchi) below the windpipe, all attempts at removal may fail, and most serious operations have to be undertaken. (See Trachea, p. 810.)

A foreign body lodged in the foodpipe (œsophagus) can sometimes be pulled up or pushed down into the stomach and passed out in a natural way, but if sharp or firmly fixed it may require a serious operation to remove it.

(iii.) **Wounds.**—In accidents to the mouth and palate no operation is likely to be required except to stop the bleeding from a wounded artery or other bloodvessel. This is an urgent need if the vessel be large, and not likely to be of any use unless done immediately, as before help can be obtained the injured man in the majority of cases will have bled to death. It may be necessary to stitch up a wound in the palate, but this is quite trivial.

*Cut-Throat.*—Immediately after the accident it is necessary to sew up the divided structures and to tie the vessels. The operation of opening the windpipe (tracheotomy) is usually also required. The windpipe during the healing may contract, and may have to be operated on more than once. These operations are rather serious.

*Fracture of the Larynx or Rupture of the Trachea.*—It may be necessary to open the windpipe to prevent suffocation, either at once or at any time before healing is complete.

This is not a dangerous operation, but it may be necessary to cut down to a broken cartilage in order to fix it in position, which is a somewhat more serious operation.

In cases of severe bleeding it may be necessary to tie one of the big vessels of the neck. This is not in itself so grave an operation, but the condition requiring it is exceedingly precarious.

### Cure.

(i.) **Scalds and Burns.**—Scalds and wounds of the mouth heal rapidly if the man is in fair health, but if he is debilitated or suffering from other disease recovery may be slow.

The food-pipe heals very badly, and an incurable narrowing frequently persists after an injury. This will necessitate feeding the patient by the stomach direct through an artificial orifice made by operation.

(ii.) **Foreign Bodies.**—The danger of foreign bodies in the mouth, throat, and larynx is immediate, as death may ensue if they are not at once removed. Once removed without operation the man is often well as soon as any soreness of the throat is healed. Foreign bodies lodged in the windpipe or the food-pipe, if not immediately fatal, may cause trouble from the formation of matter or an abscess. No time can be fixed for cure.

Where pneumonia or an abscess forms in the lungs, in consequence of infection from disease of the throat, a long and tedious illness is likely to follow.

(iii.) **Wounds.**—The time for cure of the other various injuries to the mouth and throat will largely depend on the presence or absence of inflammation and its intensity. If there is no inflammation, the majority of cases will be quite well in three weeks or earlier; but if extensive inflammation and formation of matter supervene, cure may be indefinitely postponed, and even death may ensue.

After injury to the windpipe, larynx, and trachea, where the cartilages have been exposed to the air, inflammatory matter often forms. This causes part of the cartilage to die and be separated.

The slow narrowing of the windpipe is very difficult to cure, and when once cured tends to recur, so much so that it may be necessary to leave a permanent artificial opening in the windpipe.

Narrowing of the food-pipe is most intractable, and may make a permanent artificial opening into the stomach necessary. Even then it often leads to permanent incapacity, exhaustion and death. (See Recurrence.)

Broken cartilages are serious, and take a long time to heal. The opening of the windpipe (tracheotomy) in uncomplicated cases will soon heal. The tube will require to be kept in only so long as there is a risk of the throat swelling, with the consequent difficulty in breathing. In the rest of the throat the time for cure depends on the position and severity of the injuries. In any case the cure will rarely be less than a month, but in favourable circumstances should not be much more.

### Return to Work.

(i.) **Scalds and Burns.**—Injuries to the mouth are as a rule not serious, and as soon as they are healed the man can return to work.

In scalds and burns the man can return to work as soon as healing is complete. The constriction caused by contractions of scars after burns may incapacitate a man for a long time, and even indefinitely. (See below, Recurrence.)

(ii.) **Foreign Bodies.**—See Cure.

(iii.) **Wounds.**—The main difficulty preventing the man from returning to work will be some form of narrowing of wind or food pipe. In all cases where big vessels have been divided, whether in the mouth or throat, the consequent weakness may delay the period of convalescence for at least some three or four weeks.

*Cut-Throat.*—The patient is quite incapable of returning to work until healing is complete. If the windpipe becomes narrowed, the incapacity will be very prolonged, or may be permanent. Impairment of the voice may remain and incapacitate from various occupations.

In fractures of the windpipe, larynx, or trachea, the man is



incapacitated until healing is complete. In slight cases of fracture or of blows without fracture there is no incapacitation. Hoarseness may remain, which may make the man unfit for some forms of work.

### Recurrence.

The effects of injuries to the throat which tend to recur are bleeding and subsequent contractions. Contractions tend constantly to recur even after treatment. Bleeding from large vessels may occur at any time during the first fortnight, but not after the wound is soundly healed.

### Occupation Diseases.

Professional singers, orators, actors, and others whose callings involve constant use of the voice, are especially prone to vocal troubles, which may be regarded as arising out of their occupations.

The hoarseness or loss of voice may be due to congestion or thickening of the vocal cords, or to small nodules or warts, or to imperfect action of the muscles.

These affections, however, are caused not so much by over-use as by faulty voice production, and by using the throat when inflamed or when disease of the nose prevents proper production of the sound.

### Diagnosis.

(i.) **Burns, Scalds, etc.**—Scalds, burns, and poison burns always show visible signs within the mouth, and are easily recognized if seen shortly after the injury.

These conditions can readily be distinguished from inflammation of the mouth (stomatitis) due to disease. The white patches sometimes caused by burns or scalds may be imitated to some extent by diseases such as tonsillitis, diphtheria, or scarlet fever; but in these the patches are confined to the neighbourhood of the tonsil, whereas burns and scalds always leave their mark in the mouth as well.

At a late period it may not be possible to distinguish with certainty such an injury from a throat inflamed from other causes.

(ii.) **Foreign Bodies.**—Usually a foreign body in the upper part of the throat can be seen readily either directly or with the laryngoscope. If it has been passed farther down the

windpipe, it can rarely be seen, and its presence must be diagnosed by the symptoms of difficulty of breathing and the signs of the blocking of the air-tubes on listening to the chest.

A foreign body in the food-pipe (œsophagus) is likewise invisible, and must be diagnosed by the symptoms. If an attempt be made to pass a long flexible rod (bougie) down the food-pipe into the stomach, it will be stopped by the foreign body.

The X rays are of great value in detecting the presence and position of foreign bodies, and recently a method has been invented by which a long tube lit with electric light may be passed down the air-pipe or the food-pipe, and the foreign body seen and removed.

(iii.) **Wounds.**—These injuries when the result of a blow are usually obvious, but it may be difficult to determine whether there is or is not a fracture of the cartilage, especially after the swelling of the neck has become very great. Fracture is probably present when there is much bleeding into the throat, or any entry of air into the tissues.

Death of the cartilage results from disease as well as from injury; if the case be only seen at a late stage, it may be impossible to determine the original cause.

### **Malingering.**

Simulation of results of injury to the throat presents no special feature, and its detection depends on careful examination and general principles.

### **Loss of Voice (Aphonia).**

The voice is produced by the vibrations of the two fibrous vocal cords placed at the level of the Adam's apple in the larynx. It is essential for its proper production that the cords be firm and smooth, their edges straight and sharp, and that they should be able to move easily, so as to lie parallel to each other, with a narrow chink between. Any inflammation of the vocal cords (which may be due to accident) will result in hoarseness or loss of voice, which recovers as the inflammation subsides. If a permanent destruction of, or a rent in, one cord has been produced by a cut or a sharp foreign body, the loss of voice may be permanent. The reality of the damage can easily be verified by inspection with the laryngoscope.

Another very common form of loss of voice occurs without any abnormality of the vocal cords, and is due to imperfect action of the muscles which bring the cords together. It is called "functional aphonia," and is frequently seen in hysteria, and may accompany a very slight catarrh in nervous women. It may occur as one of the symptoms of neurasthenia or of the general debility which sometimes comes on after an accident to any part of the body. The actual sounds of speech are formed by the mouth, and are not lost after injury to the vocal cords; therefore the power of whispering always remains.

### Criminal and Self-inflicted Wounds.

**Foreign Bodies.**—Insane persons have frequently committed suicide by stuffing such articles as a stocking into their mouth and throat.

**Injuries to the Larynx and Trachea.**—Wounds involving the large bloodvessels are dealt with under the head of Vessels.

The throat may be cut in four places :

(a) Immediately under the chin, above the Adam's apple. The cuts high up go deeply into the thick muscles of the tongue, and never reach the throat at all. They will heal readily, and are not likely to do very serious harm except from wounding bloodvessels.

(b) Just above the Adam's apple (the thyroid cartilage). The cut may go through the tip of the windpipe at this level, and reach the food-pipe behind. The cut will be above the vocal cords, which will not be touched.

(c) Across the Adam's apple. The cuts here are not likely to be serious, as they will be unlikely to penetrate through the hard cartilage.

(d) Just below the Adam's apple the windpipe is easily opened by a cut, and here also the food-pipe may be cut. The danger of this lower cut consists in the fact that the cut lower end of the windpipe may curl back into the wound, close its orifice, and suffocate the man; or if it does not cause a fatal result from this cause, the lungs may become inflamed from the presence of the decomposing blood which has run down the windpipe.

When the windpipe is cut across in these ways, it is usually necessary to keep the wound open artificially for a time. The whole throat frequently swells up from the results of the injury, and so the cut ends of the windpipe may become closed.

It may be necessary to perform tracheotomy (the operation of artificially opening the windpipe) below the wound, to enable the man to breathe, on account of the danger caused by the swelling.

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*For legal cases of injuries to the Throat, see CASE GUIDE : Throat.*

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### THYMUS.

*See* CHILDREN—THYMUS.

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### TONGUE.

*See* THROAT.

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### TOOTH.

*See* TEETH

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### TOXINES, TOXÆMIA.

*See* INFECTION.

# THE TRACHEA.

By JAMES BERRY,

B.S., F.R.C.S.,

Surgeon to the Royal Free Hospital and to the Mount Vernon Hospital for Diseases of the Chest ;

AND

THOMAS D. LISTER,

M.D., B.S. (LOND.), M.R.C.P.,

Physician to the Mount Vernon Hospital for Diseases of the Chest and to the Royal Waterloo Hospital.

## Head-note.

THE vital results of accidents to the air-passages are—

1. Obstruction to the breathing (suffocation).
2. Extension of inflammation into the lung substance.

## Technical Terms.

*Bröunchi*.—The main divisions of the windpipe to the right and left lung.

*Bröunchiöles*.—The small subdivisions of the bronchi.

*Bröunchitis*.—Inflammation of the bronchi and bronchioles.

*Catarrh*.—Mild inflammation with discharge from a mucous membrane.

*Mucö-pürulent*.—Containing mucus and pus (matter).

*Mucöus Membrane*.—The moist skin lining of the interior parts of the body that are accessible to air.

*Trächēitis*.—Inflammation of the windpipe.

*Trächēötömy*.—The operation of opening the windpipe.

*Trächēa*.—The windpipe. [Figs. 186-189.]

## Anatomy.

The windpipe is a tube composed of membrane and rings of gristle, or cartilage. It leads downwards from the larynx, or voice-box, to behind the upper part of the breast-bone, and is

about  $4\frac{1}{2}$  inches long. It divides into two branches, which pass to the right and left lung respectively, there dividing and subdividing to distribute the air into all parts of the lung.

### Consequences of Accident.

The chief accidents which may occur to the air-passages are—

- (i.) Wounds.
- (ii.) Foreign bodies.

(i.) **Wounds of the Air-Passages.**—Such wounds occurring within the chest apart from wounds of the lungs or great vessels are so rare as to be of no practical importance. Rupture of the trachea has occurred, and, unless there be an immediate operation, the result is death from suffocation.

(ii.) **Lodgment of Foreign Bodies within the Tubes.**—The slit of the larynx, or voice-box, does not exceed 1 inch in length, and any foreign body which can pass this slit may obtain access to the lower air-passages.

The usual bodies found are—

- (a) Particles of food, meat, bones, beans, seeds, nuts.
- (b) Small coins, buttons, pins, and similar objects, which are often held in the mouth.
- (c) Small pointed objects, such as seeds or grass.
- (d) Teeth or portions of teeth, real or artificial, and small dental instruments or pieces of broken instruments.

These bodies may be divided into two classes :

1. The relatively bulky, which tend to block the tubes.
2. Small sharp particles or pointed objects which act as irritants.

The immediate effects of the introduction of a foreign body into the air-passages are violent irritation with paroxysmal coughing, and difficulty of breathing in proportion to the amount of lung which is cut off by the obstructing foreign body.

The subsequent effects depend upon the amount of change produced in the lung by obstruction or irritation of the foreign body, and upon whether disease be set up by microbes.

Such changes may occur very quickly, serious or fatal diseases sometimes occurring within a few weeks, or even within a few days. On the other hand, a smooth foreign body

not causing actual obstruction may lie for months, or even years, without giving rise to prominent symptoms.

But secondary changes in the lung may be suddenly set up, and make rapid progression in a comparatively short time, if the foreign body be not at once removed.

Foreign bodies, if left within the air-passages, will almost inevitably sooner or later cause serious, if not fatal, symptoms.

### Disease.

1. **Caused by the Accident.**—The result of lodgment of foreign bodies in the air-passages is blocking, which, if complete, produces collapse of the portion of the lung affected.

The collapsed lung then undergoes further inflammatory changes. Mortification is very apt to take place around the foreign body, and to lead to gangrene of the lung. For the effects of small sharp particles, see Lungs.

General blood-poisoning, with the formation of abscesses in distant parts is likely to occur from septic pneumonia, gangrene of the lung, or bronchiectasis which has been set up by the irritation of foreign bodies.

2. **Existing before the Accident and aggravating its Effects.**—Any old lung affection is likely to be accentuated by the presence of a foreign body.

### Operation.

A foreign body is sometimes coughed up spontaneously. If this does not occur soon after its lodgment, an operation for its removal is urgently demanded.

This must be done either (a) *per vias naturales*; (b) through a tracheotomy wound; or (c) through the chest wall by direct incision.

Should the secondary changes already indicated have occurred in the lung, secondary operation for them may be required—*e.g.*, opening an abscess or draining of a cavity.

All operations for the removal of foreign bodies from the air-passages are necessarily serious. The danger increases considerably with the lapse of time between the lodgment of the foreign body and the operation, and with the difficulty experienced in its removal. The latter depends partly upon the nature of the foreign body, and partly upon its situation.

### Cure.

If the foreign body be soon removed *per vias naturales*, recovery is a matter of a few hours.

Should tracheotomy have been performed, and no complications ensue, the patient may expect to be well in a few days. If one of the larger operations through the chest wall has been necessary, recovery will probably not be complete until many weeks, or even months, have elapsed.

If there has been much delay in performing any of the above operations, the consequences are likely to be much more serious. Recovery will be proportionately prolonged, or become impossible.

### Return to Work.

If the foreign body has not been removed and is not causing urgent symptoms, the patient may be able to do light work, although liable to occurrence of severe and urgent symptoms at any moment.

If the foreign body has been successfully removed and no inflammatory changes in the lung have been set up, recovery is complete, and the patient is capable of doing as much work as he was before the accident.

If marked inflammatory changes in the lungs have occurred, the capacity for work is naturally impaired. (See Lungs.)

There is a possibility of recurrence of the *symptoms* of a foreign body in the lung when either (1) a foreign body has erroneously been supposed to have been got rid of by coughing, or (2) a foreign body becomes dislodged from an insensitive to a sensitive part of the lung; or (3) if removal of parts of a foreign body or bodies has taken place.

**Occupation Diseases.** See Lungs.

### Diagnosis.

The X-ray examination for foreign bodies in the air-passages, where these are supposed to be of a mineral or bony nature, should on no account be omitted.

In addition to the first paroxysmal coughing and its repeated recurrence, the signs and symptoms of blocking of a considerable air-tube are those of the secondary consequences, viz.: collapse, pneumonia, abscess, fibrosis, and bronchiectasis.



Pre-existing disease will be indicated by the history of the symptoms.

The locality of the signs of disease in the chest will as a rule distinguish pre-existing phthisis from the conditions due to a foreign body.

#### **Malingering.**

The symptoms of an actual foreign body in the lung are frequently wrongly diagnosed as hysterical simulation. A patient rarely pretends that he has a foreign body in his lungs.

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*For legal cases of injury to the Trachea, see CASE GUIDE : Trachea.*



FIG. 190.—DIAGRAM OF THE LIFE-CYCLE OF *PLASMODIUM VIVAX*.

1, Sporozoite entering red cell ; 2, trophozoite ; 3-4, schizont ; 5, merozoites ; 6, merozoites entering red cell ; 7, young trophozoite ; 8a-10a, development of a microgametocyte ; 8b-10b, development of a macrogametocyte ; 10c-10e, parthenogenesis ; 11a-12a, formation of a microgamete ; 11b-12b, formation of a macrogamete ; 13, zygosis ; 14, ookinete ; 15, oocyst ; 16, formation of sporoblasts ; 17, formation of sporozoites ; 18, cyst ruptured and sporozoites escaping ; 19a, sporozoites infecting the ovary ; 19b, sporozoites infecting the salivary glands ; 21, sporozoites escaping from the salivary duct and entering the human skin ; 22, this indicates that the further development of the sporozoites infecting the ovary is unknown.

(From Castellani and Chalmers' "Tropical Medicine.")

# ACCIDENTS OCCURRING IN THE TROPICS.

By LIEUT.-COLONEL ANDREW DUNCAN,

I.M.S. (RETIRED), M.D., B.S. (LOND.), F.R.C.P., F.R.C.S.,

Lecturer on Tropical Diseases, London School of Tropical Medicine, and  
Westminster Hospital Medical School; Fellow of  
King's College, London.

## Head-note.

THE accidents which are essentially tropical are sunstroke, and snake and small insect bites.

The serious effects that are likely to result from long residence in the tropics follow: Malaria, dysentery, sunstroke. (But see below, Disease.)

## Technical Terms.

*Ague*.—Malarial fever; a fever which recurs at regular or irregular periods and is due to the Malarial Organism. (See Malaria.)

*Ague Cake*.—A spleen enlarged, consequent on repeated malarial attacks. [For Spleen, see Fig. 168.]

*Amœba (Coli Dysentericæ)*.—An organism which lives in the large intestine; there are at least two distinct species, one of which causes tropical dysentery and tropical liver abscess.

*Antivenin*.—A substance allied in origin and principle to the anti-toxines; it is injected into the system, and neutralizes snake poison. It is extensively manufactured in the Government laboratories in India.

*Dysentery*.—Under this term are embraced several varieties of disease, the acute form of which is characterized by pain and the frequent passing of blood and mucus, the more chronic by diarrhœa alternating with constipation and a tendency to recurrence. There are three forms of acute dysentery: (a) Amœbic; (b) bacillary; (c) the dysentery of war, in which no organism has been found in some cases.

*Enteric Fever*.—Another name for typhoid fever.

*Insolation*.—The technical name for sunstroke.

*Malaria.*—Malaria is a disease produced by certain parasites which undergo a cycle of development in the mosquito and in man. [Fig. 189.] In man the parasites inhabit the red blood-corpuses, where they form spores, the production of which is associated with the attack of malarial fever. An attack of fever is characterized, as a rule, by three stages: a cold, a hot, and a sweating stage.

The chief varieties of malaria are the intermittent and the remittent. The intermittent occurs in three forms: (a) Quotidian, the attack occurring every day; (b) tertian, the attack occurring every other day; (c) quartan, the attacks occurring with an interval of two clear days in between. The remittent fever is either continuous or the period of recurrence is at irregular intervals. Frequent attacks of malaria result in anæmia and enlargement of the spleen.

*Quartan Ague, or Malaria.*—The form of malarial fever in which the attacks recur every fourth day. Counting exclusively the days on which the fever occurs, there are two clear days' interval without fever.

*Quotidian Ague or Malaria.*—The form of malarial fever in which the attacks recur daily.

*Spleen.*—A large gland lying under the lower left ribs, and to the left of the stomach. It is about 3 inches long, 2 inches wide, and  $1\frac{1}{2}$  inches thick in measurement. It gets enlarged in many fevers, notably typhoid and malaria, and in many other diseases. In malaria, after many attacks, instead of going down to the normal size, it remains in a hard, swelled condition, called "ague cake." (See Spleen, p. 753.) [Fig. 169.]

*Shru.*—A very dangerous disease occurring in the tropics, and in temperate climates amongst those people who have formerly lived in the tropics. It is characterized by catarrh of the whole or part of the alimentary canal. The chief symptoms are: frothy white diarrhœa, sore mouth, and progressive emaciation.

*Tertian Ague, or Malaria.*—An attack of malarial fever in which the ague attacks recur every other day. (See above, Malaria.)

*Tetanus, or Lockjaw.*—One of the most fatal of diseases. It occurs from the infection of a wound by a bacillus, which causes rigidity of the muscles of the body and death. (See Tetanus, p. 787.)

### Anatomy.

There is no special feature of long existence under a tropical sun, except that chronic malaria will enlarge the spleen. Sun-stroke, if uncomplicated, may leave no sign, and poisonous bites create no anatomical feature.

### Consequences of Accident.

The only accidents which, on account of their nature, can be described as specialities of the tropics are:—

(A) Poisonous bites or wounds caused by (i.) snakes, (ii.) centipedes, (iii.) scorpions; and (B) heatstroke.

(A) **Poisonous Bites or Wounds.**

(i.) *Snake-Bite*.—If the snake is deadly, the man dies, unless the antivenin, which neutralizes the effects of the snake-bite, is injected in time, when the bitten man recovers with apparently no serious consequences.

The bite of an English viper is poisonous, though it rarely causes death. A man was bitten on the hand by a viper which was kept in captivity. It was during the winter, when the bite is said to be less dangerous than in summer, and the only result was that two small blood blisters appeared where the teeth had entered. Nothing was done for three-quarters of an hour, when the wound was cauterized; but long before this the poison must have spread all over the body, as the circulation of the blood is complete in a few seconds. He never suffered the slightest inconvenience, except from the unpleasantness of the cauterizing red-hot iron on his hand.

(ii.) *Centipedes*.—The tips of the feet of centipedes are sharp and poisonous, and cause most painful punctures. A parallel line of numerous small points appear where the feet of the insect have pierced the skin. Though very painful, no serious consequences are likely to follow.

(iii.) *Scorpions*.—The sting of scorpions is very painful, and rarely fatal to adults, though to children it has been fatal.

(B) **Heatstroke**.—This is probably a great deal commoner in England than is generally recognized, as during the very hot weather people suffer from slight sunstroke, causing giddiness, headache, and vomiting; the cause of which is not always correctly diagnosed. The sun may affect individuals in various ways, as follows:

1. Heat Collapse; 2. Heatstroke.

(a) Direct heatstroke or sunstroke, where the patient is exposed to the sun's rays.

(b) Indirect heatstroke, where the patient is under cover.

1. **Heat Collapse**.—Here the patient suddenly turns giddy and falls. His skin is moist and cool, his breathing hurried but never noisy (stertorous). His pulse is small and soft, the pupils dilated and the temperature at or below normal; there is also no complete loss of consciousness.

2. **Heatstroke**—(a) *Direct Heatstroke or Sunstroke*.—This may show itself in one of the following ways:

(i.) The sufferer is unaccustomed to the fatigue of heavy

exercise—*e.g.*, marching, and is especially liable to be attacked when his skin does not perspire, as when the air is moist as well as hot. Violent headache occurs, and the man falls down in convulsions, with absolute insensibility, incontinence of urine, difficult respiration, and the teeth firmly clenched.

(ii.) The individual streams with sweat, becomes rapidly paler, with swollen face and injected eyes, quick and shallow respiration, and then falls to the ground, but consciousness is not usually entirely lost.

(iii.) The individual becomes exceedingly thirsty, and suddenly loses consciousness, without convulsions.

(iv.) The individual after tiring work in the sun—*e.g.*, a long march—is seized with a terrific racking headache, accompanied by intolerance of light, and unconsciousness. In this form recovery is extremely slow; he suffers from intense headache for from six or eight weeks without cessation, except an amelioration at nightfall, after which period the headache gradually leaves him. (See below, Cure.)

(b) *Indirect Heatstroke*.—Here the patient is under cover when attacked, in a hot close house, or under any similar condition. He becomes pale, with nausea, colic and incontinence of urine. Next follows convulsions with cyanosis, dyspnoea and unconsciousness. The breathing is stertorous, the pupils contracted, and the temperature of the body may reach 110° F., and remain high for some time after death which is common.

### Disease.

1. **Caused by the Accident.**—The bites of snakes and insects, when once cured, are not likely to leave any after-effects. Sunstroke leaves an irritability of the nervous system, when any accident will be likely to be aggravated.

2. **Existing before the Accident and aggravating its Effects.**—**Effects of Long Residence in the Tropics.**—We may commence our remarks on this section by stating, first of all, that the European who starts his career in the tropics is usually, more or less, a selected individual. The military and civil servants of India, for example, have first to undergo a medical examination as to fitness for tropical life, whilst individuals engaged in England by private firms for work in the tropics are also medically examined as regards their general health. Secondly, all statistics prove that the first five years of residence in the tropics are attended with the greatest risk of ill-health or death, as shown in the death-rate of such diseases

as enteric fever and dysentery, which kill off the weakly ones.

Long residence in the tropics is compatible with perfect health. We fully agree with Mr. Cantlie, who states that individuals who have passed through their initial malarial fevers, and have lived in the tropics for thirty years, with occasional changes home, have as good chances of long life as their contemporaries who have never been exposed to the peculiar danger of tropical life. This is exemplified by the presence of so many healthy veterans at the East Indian and Oriental Clubs, and by the obituary notices at an advanced age of old tropical residents.

(i.) **Obesity.**—Many individuals who have resided in the tropics develop an abnormal amount of adipose tissue. Fat people are not such favourable people as regards effects of accidents as others, for their hearts usually suffer from some amount of fatty degeneration.

(ii.) **Anæmia.**—One of the most marked and lasting effects consequent on a long residence in the tropics is anæmia. Anyone landing in Bombay is at once struck with the blanched, anæmic colour of the skin of the residents of that city. The anæmia will be marked if the subject has lived in malarial regions, as the malarial organisms flourish at the expense of the red blood-corpuscle. Again, the higher the temperature the more rarefied is the air, the less the quantity of oxygen present in a given volume, so that less oxygen is inhaled at each respiration. Thus we find a former resident in the tropics, if still anæmic, will not bear the effects of an accident so well.

(iii.) **Malaria.**—Malarial diseases will exert an influence on accidents in the above-mentioned way; a broken bone, for instance, may not so readily form healthy union. Again, should the individual have been invalided from the tropics for severe malarial infection, and shortly after his return to England receive an injury to the abdomen, we have to take into consideration the effect such an injury may have on the enlarged spleen. If the malarial patient does not return to the tropics, but continues to reside in England, in all probability he will attain complete recovery, and the disease will not have any effect on his constitution.

(iv.) **Liver Abscess.**—A tropical abscess which has been evacuated, and finally healed, will not exert material influence on any subsequent injury.

(v.) **Enlargement of Spleen.**—See above, Malaria and Spleen.

### Operation.

There is nothing special to note with regard to operations rendered necessary through a "tropical accident." Operations are performed with complete success, especially on the natives of the land. Anæmia may render an operation more serious. Antivenin must be injected immediately after a snake-bite, and cocaine is also injected with success as a rapid cure for scorpion-bite.

### Cure.

**Snake and Insect Bites.**—These are either fatal or cured in a few days more or less.

**Sunstroke.**—This may leave absolutely no trace, the man becoming quite well and healthy after it as if it had never occurred. After some of the direct forms of heatstroke, especially (iv.) above, sudden attacks of distressing palpitation of the heart may occur for some two years after the sunstroke. If he is a sufferer from syphilis, or alcoholic or other excesses, or has more than one attack, he may be incapacitated for some time, and be left with a permanent headache. Some authorities are of opinion that severe sunstroke is one of the causes of affections of the brain, and possibly of insanity.

### Return to Work.

The immediate cure of sunstroke is usually a matter of some weeks before the man is fit to return to full work. In severe cases he must be invalided home and not return to the tropics. (See above, Cure.)

### Recurrence.

When sunstroke has once happened, it is much more likely to occur again as the head is more sensitive to the sun after one attack than it was before.

### Occupation Disease.

Any occupation entailing exposure to the direct or indirect rays of the sun increases the risk of sunstroke.

### Diagnosis.

The diagnosis from the cerebral form of malarial fever may be necessary, and is apt to be very difficult. For its determination the medical attendant should search for the malarial organism, a history of malaria and an enlarged spleen. Another disease which might be confused with sunstroke is cerebro-spinal



fever, but here there will be retraction of the neck, unequal pupils, squint, etc.

**Malingering.**

Malarial attacks could possibly be imitated, but the difficulty for the malingerer is to get his temperature to go up as it should in malaria. Microscopic examination is the surest method of diagnosis of malaria; the organisms can always be found during the attack of fever by anyone skilled in recognizing them.

*For legal cases of Tropical Injuries, see CASE GUIDE: Tropics.*

**TUBERCULOSIS.**

*See* LUNGS, JOINTS, PERITONEUM, INJURIES TO CHILDREN.

**TUMOURS.**

*See* ACCIDENTS IN CHILDHOOD—BONES. BONES, BREAST, GENITAL ORGANS—FEMALE.

**UMBILICAL HERNIA.**

*See* RUPTURE—UMBILICAL.

**ULCER.**

*See* NOSE, SKIN, ETC.

**URETHRA.**

*See* GENITAL ORGANS—MALE AND FEMALE.

**UTERUS.**

*See* GENITAL ORGANS—FEMALE.

**VACCINES.**

*See* INFECTION.

**VAGINA.**

*See* GENITAL ORGANS—FEMALE.

**VARICOSE VEINS.**

*See* VESSELS—VEINS.

**VEINS.**

*See* VESSELS.

**VERMIFORM APPENDIX.**

*See* APPENDIX.

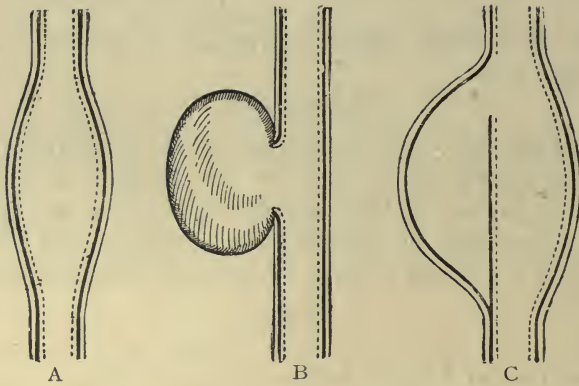


FIG. 191.—ANEURISMS OF VARIOUS KINDS.

A, Fusiform, or swelling of the entire circumference of the artery. B, Sacculated or bulging of one side of the artery. C, Dissecting, or bulging of one side, with separation of the coats of the artery so that blood enters between them.

(From Rose and Carless's "Surgery.")



FIG. 192.—ANEURISM.

An aneurism removed from the body and bisected longitudinally, showing a large clot, which is laminated—*i. e.*, made of many layers.

(From Rose and Carless's "Surgery.")



FIG. 193.—ARTERIO-VENOUS ANEURISMS.

A, Artery; V, vein. 1, Aneurismal Varix: artery communicating with the vein, the walls of which are stretched. 2, Varicose aneurism: a false aneurism, or pouch, existing between the artery and vein. The walls of the vein are also stretched.

(From Rose and Carless's "Surgery.")

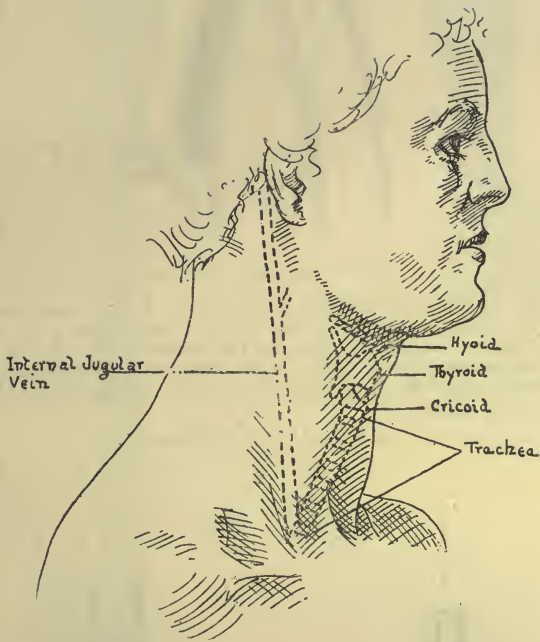


FIG. 194.—POSITION OF THE DEEP INTERNAL JUGULAR VEIN.

The vein commences at an opening (the jugular foramen) in the skull behind the ear, where the blood from the internal parts of the head, especially from the lateral sinus, is poured into the internal jugular vein. (For the lateral sinus, see Figs. 52, 53, 54.) The internal jugular vein unites on each side of the neck with the vein from the arm (the subclavian vein) to form an innominate vein. On the left side, at the junction of the two, the thoracic duct enters. (See Lymphatics.)

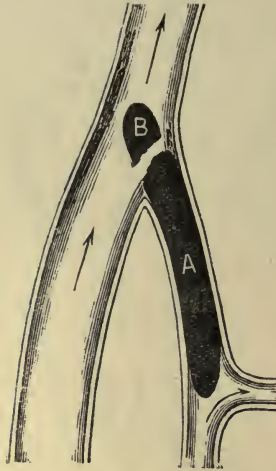


FIG. 195.—THROMBUS AND EMBOLUS.

A vein and its branches opened from the front and shown diagrammatically, the arrows showing the direction of the blood-current towards the heart. A, A large thrombus completely blocking the smaller vein; B, a detached fragment just starting on its path, as an embolus, towards the heart. Notice that, being a vein, the channel widens towards the heart and in the direction of the flow of blood.

(From Rose and Carless's "Surgery.")

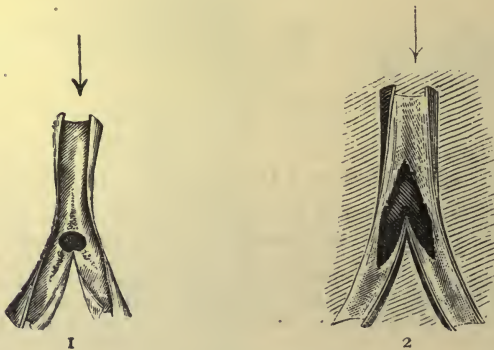


FIG. 196.—AN EMBOLUS.

Two illustrations of arteries opened from the front, showing diagrammatically the method by which an embolus is caught, and the consequences. 1, A small embolus caught at the forking of an artery. 2, The same embolus after a lapse of some time. A blood-clot has collected round it, and the channel is completely closed. Note the direction of the flow of blood as indicated by the arrows, and that the channels become smaller in the direction of the flow of blood. If these arteries were in the lungs, the embolus from Fig. 195 will have passed through the heart and larger pulmonary arteries, and got caught in the bifurcation, where the channel was too small.

(From Rose and Carless's "Surgery.")

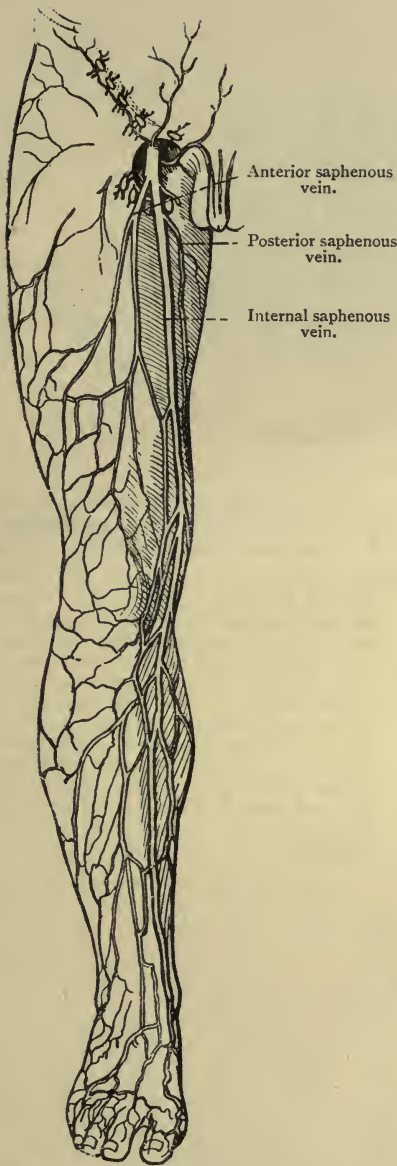


FIG. 197.—THE SUPERFICIAL VEINS OF THE LEG, SHOWING THE VEINS WHICH ARE USUALLY THE SITE OF "VARICOSE VEINS."

The course of the main "lymphatics" lies very close to that of the veins. (See Fig. 200.) Also note the way in which the veins branch, re-branch, and cross-branch to each other. This is called "anastomosis."

(From Buchanan's "Anatomy.")

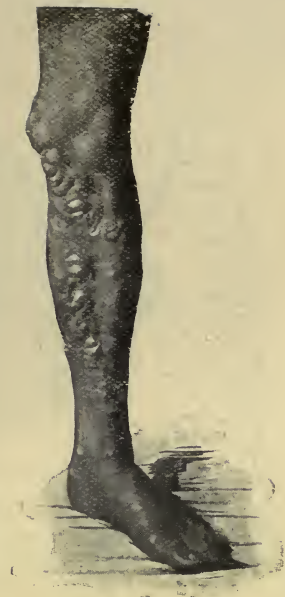


FIG. 198.—VARICOSE VEINS OF THE INTERNAL SAPHENOUS VEIN OF THE LEG. (See Fig. 197.)

(From Rose and Carless's "Surgery.")



FIG. 199.—PILES: VARICOSE VEINS OF THE LOWEST PART OF THE PORTAL SYSTEM, OR VEINS, OF THE BACK PASSAGE, OR RECTUM, COMMONLY KNOWN AS "PILES."

(From Rose and Carless's "Surgery.")

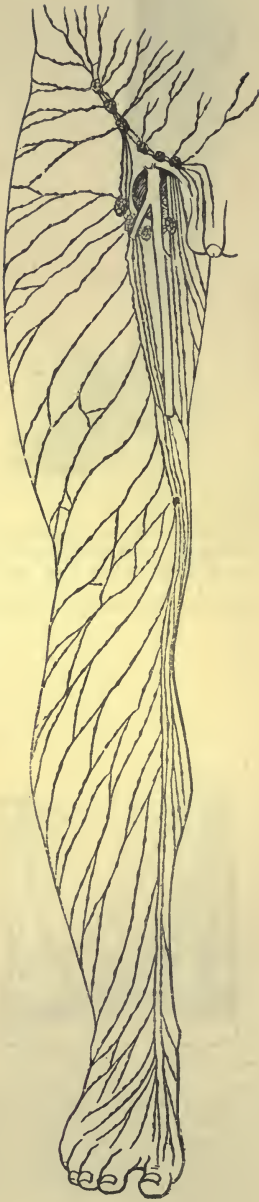


FIG. 200.—LYMPHATICS AND LYMPHATIC GLANDS OF THE SURFACE OF THE LEG, LOWER PART OF THE ABDOMEN, AND EXTERNAL GENITALIA.

The six small black masses in the fold of the groin are the lymphatic glands. The three outer ones are connected with the lymphatics of the skin over the hip-bone, and the three inner ones with the skin of the lower part of the abdomen and external genitals. It is these glands which, by their enlargement from a sore on the external genitals, produce some swelling which resembles a rupture. (See Figs. 155, 156, 157.) The group of four glands placed a little lower down collect the lymph from the surface of the skin of the leg. They will become enlarged in cases of sores of an unhealthy nature on the leg or foot.

(From Buchanan's "Anatomy.")

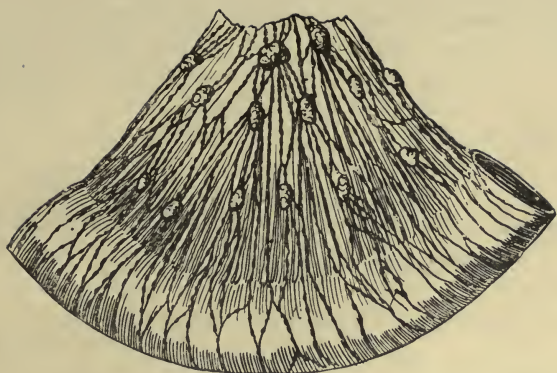


FIG. 201.—INTESTINAL LYMPHATICS.

A piece of the small intestine with the mesentery, showing, diagrammatically, the lymph canals (here called "lacteals") and the numerous glands. These lacteals collect the products of digestion and convey it to the thoracic duct.

(From Buchanan's "Anatomy.")

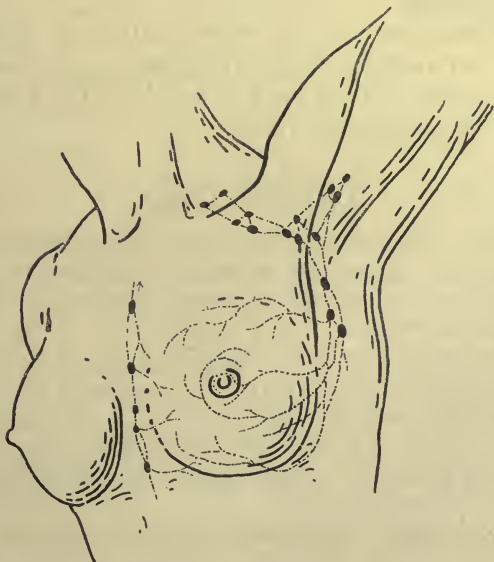


FIG. 202.—LYMPHATIC GLANDS AND VESSELS OF THE BREAST.

# VESSELS: ARTERIES, CAPILLARIES, AND VEINS; LYMPHATICS.

By LOUIS BATHE RAWLING,

M.B., B.C. (CANTAB.), F.R.C.S.,

Assistant-Surgeon and Demonstrator of Operative and Practical Surgery  
to St. Bartholomew's Hospital and Medical School.

## ARTERIES, CAPILLARIES, AND VEINS.

### Head-note.

THE vital results of injury to the bloodvessels are—

1. Bleeding.
2. Weakening of the vessel wall, and in the case of arteries the later development of an aneurism.
3. Mortification of part or whole of the region supplied by the injured vessel.

### Technical Terms.

*Anastōmōsis*.—The union of branches of two neighbouring arteries or veins, so that if obstruction occurs in one direction the supply of arterial blood and the drainage of venous blood can be taken over by the neighbouring vessel. "End arteries" are those in which no such union of branches occurs. They are found in the brain, kidney, etc.; in consequence, obstruction of one of these is followed by death or loss of function of the part beyond. [Fig. 197 shows this in Veins.]

*Åneurism*.—A local distension of the wall of the artery. Aneurisms are subdivided, according to their shape, into fusiform and sacculated (pouch-like). [Figs. 191, 192.]

*Artery*.—An elastic thick-walled bloodvessel carrying blood from the heart.

*Åthērōma*.—A diseased condition of the lining walls of an artery, producing loss of elasticity and weakening.

*Calcification*.—Chalky deposits in the walls of an artery causing rigidity. A common feature of old age.



*Căpillăry.*—The capillaries are the smallest of the bloodvessels. They are of microscopic size, and form the communicating link in the circulation of the blood between the arteries and the veins.

*Lŷmphădĕnĭtis.*—Inflammation of the lymph-glands.

*Lŷmphăngĭtis.*—Inflammation of the lymph-vessels.

*Edĕma.*—Swelling of the tissues from the escape of fluid from the veins and lymphatics into the surrounding structures.

*Phlĕbĭtis.*—Inflammation in and around a vein.

*Phlĕbŏlĭths.*—Small nodules of clotted blood in the pouches of irregularly distended veins.

*Portal System of Veins.*—The vessels which collect the blood from the abdominal organs and carry it to the liver, from which organ the blood is further carried on to the heart.

*Stĕnŏsis.*—Narrowing of a vessel from disease of its walls.

*Thrŏmbŏsis.*—The clotting of blood in a living bloodvessel.

*Văricŏse Veins.*—Irregular pouching and distortion of veins, usually resulting from some degree of obstruction to the venous return. [Figs. 198, 199.]

*Valves.*—Flaps of tissue, semilunar in shape, directed towards the heart, projecting into the central canal of a vein, and aiding in the support of the column of blood. [For Heart Valves, see Figs. 97-101.]

*Vein.*—A thin-walled bloodvessel conveying blood to the heart or liver (the portal system). The veins of the extremities possess well-marked valves.

### Anatomy and Physiology.

**Arteries.**—The left auricle of the heart is supplied with pure blood from the lungs. [Figs. 98-100.] The blood then passes into the left ventricle, from whence it is pumped into the arteries, and so conveyed to the body. This blood which leaves the heart from the left ventricle is arterial blood; that is, it contains oxygen combined with the blood colouring-matter (hæmoglobin), producing a combination called “oxy-hæmoglobin.”

The arteries divide and redivide as the distance from the heart increases, and although each separate branch is smaller than the trunk from which it starts, yet the combined capacity of the branches is considerably greater than the main arteries from which they come. The arteries are elastic tubes of varying calibre and without valves. The larger vessels are in the main embedded between muscles, or so situated as to receive all possible protection from injury. The coat of these vessels is made up of three layers, the inner of which is the more delicate. The larger vessels are named after the part or region which they supply—cerebral (the brain), brachial (the

arm), renal (the kidney), hepatic (the liver), femoral (the leg), etc. The smaller branches of the arteries usually unite (anastomose) with those of other trunks, so that, when a branch of one artery is blocked, blood may, under favourable circumstances, still be able to reach the part which would otherwise be deprived of its blood-supply. In certain parts of the body no such union of branches takes place, so that, if a branch of an artery is blocked, no blood can be supplied to the area beyond, which dies in consequence of lack of blood. Such arteries are called "end" arteries, and are especially noticeable in the brain, kidney, etc.

**Capillaries.**—The ultimate divisions of the arteries end in minute tubules with exceedingly thin walls, known as "capillaries." Although each tube is very small, yet the actual area through which blood can flow in the capillaries is very large when contrasted with that through which blood flows in the main arteries after leaving the heart; in consequence blood flows at a slower rate in the capillaries, and it is in that region that the changes between the blood and tissues occur. These changes consist, in the main, of the supply of oxygen to the tissues, the absorption of nutrient material derived from the food ingested, and the excretion by means of the kidney, skin, etc., of waste products.

**Veins.**—The union of many capillaries produces the smallest tributaries of the veins along which the blood flows, now dark in colour—venous blood, charged with impurities, and deprived of the greater part of its oxygen. The diameter of the veins increases with each union of its roots, so that a small clot (thrombus) which is formed in a small vein, and which gains entry into the blood-stream, is easily carried along the widening channels towards the heart. The thrombus may then be pumped into the lungs, obstructing some of the smaller vessels, and producing a condition known as "embolism." [Figs. 195, 196.]

Veins are thin-walled tubes of varying calibre, carrying blood from the tissues and organs of the body back to the heart. They usually accompany, and lie parallel to, the corresponding arteries. The veins of the extremities are arranged in two main groups, superficial and deep, the two systems freely intercommunicating. The deep veins are placed between the muscles, and are correspondingly supported and protected. The superficial vessels are placed between the muscles and the skin, and possess valves; these, being distributed throughout the course of the vein with a certain degree of regularity, are

normally competent to support the column of blood. During muscular contraction, and especially when the body is in the erect position, blood is driven out of the deep system of veins into the superficial; the latter group of veins then becomes distended, but, from the presence of the competent valves, quite capable of fulfilling their function of aiding the free return of the venous blood to the heart. When the valves fail, varicose veins are produced. (See below, Disease.)

The larger veins of the head and neck, chest and abdomen, possess but few valves, the blood being returned to the heart partly on account of the *vis a tergo*, and partly from the suction-like action of the heart itself. Numerous tributaries are received from the organs and tissues of the body, more or less proportionate to the size and importance of the part which is thereby drained. The larger vessels, like the arteries, are named after the organ, etc., drained. The venous blood is eventually emptied into the right auricle of the heart, from which it passes into the right ventricle, and is thence pumped through the pulmonary arteries into the lungs. [Figs. 98-100.] The pulmonary arteries rapidly break up into small branches and end in capillaries, like those previously described, in other parts of the body. The pulmonary capillaries are separated from the air in the air cells of the lung by a very delicate membrane.

Oxygen from the air in the lungs passes freely through this membrane and restores the lost oxygen to the deoxygenated blood, and carbonic acid gas passes through to the air in the lungs and is expired in breathing. The oxygenated blood now flows on through the capillaries into small pulmonary veins, the branches of which eventually unite to form the larger pulmonary veins, which empty into the left auricle, where the cycle is again started.

*Portal System of Veins.*—There is an entirely separate system of veins, called the “portal system,” which collects the venous blood from the majority of the abdominal organs, which are, however, supplied with ordinary arterial blood, for the arteries have no counterpart in the portal system. The venous blood from the intestines, pancreas, stomach, etc., is collected in a number of veins, which eventually unite into one large vein—the portal vein—which, instead of going direct to the heart, enters the liver, where it breaks up into numerous branches that finally end in the capillaries of the liver. From these liver capillaries fresh veins start, which unite, and eventually open into the inferior vena cava, the main vein draining the lower

part of the body and the legs. In the liver, changes occur in connection with that part of the food which is absorbed by the bloodvessels of the abdomen, the other part being absorbed by the lymphatics. (See Lymphatics.) Sometimes in consequence of this absorption, where the food is harmful in its nature, the liver suffers. The most marked example of such a condition is found in the absorption of an excessive quantity of alcohol, which produces the diseased condition known as "cirrhosis." In cirrhosis of the liver the flow of blood through the vessels of the liver is often obstructed, and signs of backward pressure appear, causing dilated veins, especially in two situations, in each of which they are called "piles"—viz., the ordinary piles of the back-passage, and œsophageal piles, which occur as distended veins where the œsophagus or food-pipe joins the stomach. The reason why these veins dilate so easily, when pressure is applied to the veins in the liver, is that there are no valves in the portal system, and in consequence of backward pressure of the blood these weak veins stretch.

**Blood.**—The blood is composed of two main parts, the one solid, or "corpuscles," red and white, the other the liquid, known as "plasma." The red blood-corpuscles, by means of their hæmoglobin, or staining material, are the carriers of the oxygen; the white are called "leucocytes," and are of great importance in connection with infection by bacteria, as some of them are capable of destroying bacteria. (See Infection—Phagocytosis.) [Fig. 109.]

The total quantity of blood in the body is about one-twelfth to one-fourteenth of the body-weight, and the circulation of the blood through the two cycles of the body and of the lungs, as described above, occupies about fifteen seconds. Blood is faintly alkaline in reaction and saltish in taste. The corpuscles of all mammals, with the exception of the camel, are circular and biconcave. They vary, however, slightly in size.

### Consequences of Accident.

The principal accidents which may happen to the arteries and veins are—

- (i.) Incisions.
- (ii.) Lacerations or tearing.
- (iii.) Contusions.

(i.) **Incisions.**—These are produced by swords, knives, etc. They permit of bleeding proportionate to the calibre of the vessel,

the blood being poured out on the surface of the body, amongst the tissues thereof, or into one of the so-called cavities of the body—*e.g.*, the pleura, peritoneum. In many cases, even though appropriate measures be adopted immediately, death results in a few minutes. This is more especially the case when the bleeding is derived from one of the larger vessels, and when the hæmorrhage is concealed from view.

Clean-cut wounds which do not completely sever the whole thickness of an artery are more dangerous than those mentioned in the next section. In an artery which has been completely divided, the ends tend to retract and close the wound; but if one side only of the artery is cut, the wound gapes, the cut ends are unable to retract, and the bleeding is severe. Hæmorrhage from veins is usually less serious than arterial bleeding, the blood-pressure being less, and the bleeding therefore more readily arrested.

(ii.) **Lacerations or Tearing.**—These are produced in the mangling of the limb, by gunshot wounds, by the sharp ends of a neighbouring fractured bone, etc. Injuries of this nature do not necessarily lead to such serious hæmorrhage as in the preceding case, for in the case of the artery the contraction of the vessel and the retraction of its coats aid greatly in the coagulation of the blood and in the natural cessation of the hæmorrhage.

(iii.) **Contusions.**—These are produced by kicks or blows. No immediate ill-effects necessarily result. There is, however, a tendency to damage of the coats of an artery, for injury may cause rupture of the inner coats only. These are elastic, and, when cut, recoil and contract, thus tending to obstruct the blood-flow and cause clotting.

The clotting of the blood may be of such a nature as to lead to complete blocking of the vessel (thrombosis). From this clot portions may be detached and carried yet farther to other regions (embolism). The blocking of a large vessel usually leads to gangrene or death of the regions supplied by that vessel. (See Gangrene, p. 344 *et seq.*)

Fortunately, the smaller arteries usually unite by anastomosis with other vessels, and these connecting vessels soon dilate and take on the work of the closed vessels.

Veins are more liable to contusion than arteries, as their thin walls are readily damaged and the veins are more exposed on the surface. Under such circumstances there is a local clotting of blood (thrombosis), blocking up the canal of the vein, and more or less impeding the return of blood from

the more distal regions back to the heart. The effects of this will be considered in the next section, particularly with reference to a fragment of blood-clot being broken off in a vein, carried by the blood-stream to the heart, and thence to the lungs.

The clot in an artery is less likely to become detached from the vessel wall, except in the case of an aneurism; but where such an occurrence does take place, the clot is soon caught in a vessel whose calibre is too small for the clot to pass, thus cutting off the blood-supply beyond. [Fig. 196.]

### Disease.

I. **Produced by the Accident.**—(a) **Aneurism.**—[Figs. 191, 192.] If the coats of an artery be incompletely severed, perhaps merely bruised, the resultant weakening renders the artery liable to give way before the pressure of the contained blood, and dilatations (aneurismal) result. Veins dilate and form pouches under backward pressure, but these are not called “aneurisms,” but “varicose veins.” In rare instances of a punctured wound an artery and vein communicate, thus forming a condition of “arterio-venous aneurism.” [Fig. 193.]

An aneurism is a swelling or pouch on the side of an artery which contains blood. In time the blood may clot in layers, so that eventually most of the pouch is filled with flat layers of clot. In time the cells of the body may grow into these layers and form a solid tumour, which is harmless. [Fig. 191.]

(b) **Adhesions of Joints, etc.**—If blood be effused into a joint, the changes that the clot undergoes will usually interfere with the movements of the joints, bands of fibrous tissue being formed, with resultant limitation of movement.

(c) **Pressure Symptoms.**—(a) *Brain and Spinal Cord.*—If bleeding occurs in the nervous material of the brain and spinal cord, that material will be more or less permanently damaged, with consequent loss of function and paralysis. (See Brain, p. 178.)

(β) *General.*—Muscles may be impeded in their action, nerves may be paralyzed, and veins and lymphatics pressed on and obstructed.

(d) **Gangrene.**—One of the most important results of injury to vessels is death or gangrene of the parts which depend for their vitality on a fresh stream of blood. The development of gangrene depends upon the relative importance of the vessel injured, and on the general power of recovery evinced by the

patient. Thus, a young man with healthy arteries and a strong heart may develop new vessels, or existing and anastomosing arteries may so dilate as to convey sufficient blood to the affected distal region. On the other hand, an old man, with previously diseased vessels, will fail to compensate in this manner, and the parts beyond the injury will probably die. Furthermore, injury to the more vital vessels will most certainly be followed by gangrene or death in all cases. Gangrene, whether the patient be old or young, is a most dangerous complication. (See Gangrene, p. 344.)

Gangrene is, however, less liable to occur when the vein accompanying the injured artery is itself uninjured.

(*e*) **Embolism.**—After clotting of blood in a vessel, portions of the clot are liable to become detached and transferred by means of the blood-stream to other regions, blocking their vessels (embolism). [Figs. 195, 196.]

(*f*) **Swelling of the Parts beyond.**—If a large vein be injured, the parts drained by the vein may become swollen (œdematous), and the veins below the site of the injury dilated and congested (varicose).

(*g*) **Entry of Air.**—If a large vein be torn open, air may enter and death may result. This occurrence is most likely to take place in wounds of the large vessels of the neck.

## 2. Existing before the Accident and aggravating its Effects—

(*a*) **Arterial Diseases**, such as those resulting from alcoholism, atheroma, Bright's disease, etc., are accentuated by and accentuate any injury to a large vessel, mainly from the fact that the parts dependent for their nutrition on the blood-supply received from the artery in question are rendered more liable to malnutrition or death.

(*b*) **Varicose Veins** [Figs. 198, 199.]—This condition is exceedingly common, and most frequently seen in the leg, at the back-passage “hæmorrhoids or piles,” and in the portal system, where they produce the “œsophageal piles” previously described. Varicose veins in the general venous system are either congenital or result from such interference in the return of venous blood to the heart that the veins become engorged and distended. Later on the valves may become useless, and thus add to the strain on the vessel below. Varicose veins form the well-known knotty, irregular, dark distended vessels seen in the legs. The circulation below them is frequently bad, especially, as often happens, when blood clots in the pouches of these

veins. The result is that varicose ulcers and chronic varicose eczematous conditions are common in the legs. Any of these conditions may be rendered considerably worse by injury.

*Varicose Veins of the Portal System.*—The varicose veins of the œsophagus and of the back-passage frequently bleed in slight strains without any direct injury or accident, but a direct blow over the pit of the stomach or on the back-passage may lead to very serious hæmorrhage.

*Varicose Veins of the Scrotum (Varicocele)* are common in young men without any accident.

### Operation.

(i.) **After Bleeding.**—Most cases of severe bleeding necessitate operative treatment. The indications with regard to the treatment in general are—(a) To stop the bleeding; (b) to replace the amount of fluid lost.

*To stop the Bleeding.*—The bleeding may be immediately arrested by pressure if the vessel is capable of being compressed against some neighbouring firm structure. In most cases, however, it will become necessary to expose the site of injury by a suitable incision, to expose the bleeding-point, and to apply a ligature on either side of that point.

*To replace the Amount of Fluid lost.*—This can be carried out either by allowing some pints of saline solution to flow into the back-passage, from which region it is absorbed into the patient's system, or by exposing one of the superficial veins and allowing the saline solution to pass directly into the patient's vascular system.

(ii.) **Aneurism.**—Some aneurisms may be cured by rest, dieting, and medicinal treatment. Others require surgical treatment. In the latter case the dilated portion of the artery may be excised, or the artery may be ligatured on the heart side of the injured or diseased vessel, with the hope that the diminished quantity of blood passing through the aneurism may allow of the clotting of blood in the sac of the aneurism, and under such favourable conditions the aneurism may become completely cured.

(iii.) **Adhesions.**—Adhesions are to be treated by massage and movements of the affected joint and neighbouring regions. It is often necessary that both massage and movements should be preceded by forcible movements under a general anæsthetic, with the object of breaking down the more firm adhesions present. The treatment requires to be carried out for a con-



siderable period of time, usually some weeks or months. (See Joints, p. 495.)

(iv.) **Gangrene.**—Operative treatment is usually indicated, the mortified parts being amputated. The site of amputation depends on the general condition of the patient, on the nature of the gangrene, on the region affected, and on the trade or work of the patient, due attention always being paid to the nature of artificial limb most suited to the patient's future working capabilities. (See Gangrene, p. 344.)

(v.) **Varicose Veins.**—If the varicosity affects mainly the superficial veins, and if no obstruction to the venous return exists, the veins may be cut out. Suitable incisions are made, and the affected portion of vein excised. It is, of course, necessary that the open mouths of the vessel, above and below the site of excision, should be ligatured. The "system" of varicose veins is broken up in this manner. On the other hand, when the varicosities result from marked venous obstruction, such as "piles," due to cirrhosis of the liver, operation is generally contra-indicated.

There is no operation for œsophageal piles.

### Cure.

(i.) **After Bleeding.**—The time for cure varies according to the nature of the injury. The patient may be said to be out of immediate danger from the bleeding if the hæmorrhage has stopped, and the patient is holding his own, twenty-four hours after the accident. Subsequently all depends on the early union of the wound, for the occurrence of inflammation and discharge of "matter" render a recurrence of the bleeding possible, this tendency persisting till the discharge shall have ceased and the wound healed.

(ii.) **Aneurism.**—An aneurism situated in the extremities may sometimes be amenable to surgical treatment, and complete cure may be obtained; those in other situations usually terminate fatally, after a variable period of time. In any case the trouble is certain to be protracted. The best that can be hoped from some aneurisms is that consolidation or clotting of blood will occur, and that the aneurism may become cured spontaneously. [Fig. 191.]

(iii.) **Adhesions.**—A more or less complete permanent cure may be anticipated, according to the strength of the adhesions and the energy of the treatment adopted. (See Joints, p. 495.)

(iv.) **Gangrene.**—See Gangrene.

(v.) **Varicose Veins.**—When varicose veins result from marked venous obstruction, the varicose condition is seldom open to cure, either by operation or any other method. Under more favourable circumstances operation can be carried out with every anticipation of a favourable result.

### Return to Work.

(i.) **After Bleeding.**—In minor cases of bleeding the patient may be able to return to work within a few days of the accident. In the more serious cases many months may be requisite, for though, as is indicated in the section dealing with Operation, the fluid constituents of the blood are readily replaced, the more solid constituents (the corpuscles) are but slowly re-formed.

(ii.) Return to work after an **Aneurism** has developed depends upon the size and position of the aneurism and the occupation of the patient. Those who undergo laborious work occasionally have a slight dilatation of the main artery of the chest, of which they may not be aware until told by the examining physician. A man with such dilatation should not carry on laborious work, especially if there are signs of an increase in size. Aneurisms of the vessels of the arms and legs, whether due to disease or injury, are dangerous on account of the pressure which they exert, and also from the risk of detachment of part of the clot within them, with blockage of the vessel beyond, and gangrene. If the aneurism undergoes a spontaneous cure, a compensatory circulation will develop during the period of rest which is necessary for cure, and as soon as this cure and compensation has taken place the man can return to work. This period should not be longer than, say, six months.

(iii.) **Adhesions.**—Refer elsewhere, according to the locality affected. (See Joints, etc., p. 498 *et seq.*)

(iv.) **Gangrene.**—See Gangrene, p. 344.

(v.) **Varicose Veins.**—After operation for varicose veins the patient can return to work as soon as healing has taken place—say one month after the operation. The operation is quite a trivial one, and the man is likely to be completely cured of his troubles. (For indications of the operation, see previous section.)

### Recurrence.

(i.) **After Bleeding.**—Properly treated, bleeding does not recur unless the wound discharges matter, in which case the

clot may give way and the bleeding occur again. This is exceedingly rare in the present day of antiseptics, but in the old days it was a danger which every surgeon had constantly to face.

(ii.) **Aneurism.**—Recurrence after cure is rare.

Those engaged in laborious work, whose vessels are sufficiently weak or whose labour is sufficiently heavy for an aneurism to occur in their body, are, of course, likely to have a fresh aneurism appear if they return to their former condition after cure. This new aneurism must not be confused with recurrence.

(iii.) **Adhesions.**—Adhesions once cured show little tendency to return, but, as all adhesions tend to contract, the process of contraction may continue after a period of apparent cure.

(iv.) **Gangrene.**—See Gangrene, p. 344.

(v.) **Varicose Veins.**—Varicose veins of the body, are not usually caused by accident, but by continuous strain or disease. After the cure of some veins others may appear; this is, of course, not recurrence. Varicose veins of the portal system, when they occur at the end of the œsophagus, are not directly amenable to surgical operation, though they may improve under treatment, surgical or otherwise, of cirrhosis of the liver, and become worse if the disease is aggravated. Varicose veins of the back-passage, external or internal piles, can usually be cured by an operation. The actual piles themselves, which are excised by operation, cannot of course recur, yet neighbouring veins sometimes dilate and produce new piles. It may, perhaps, be again stated that operations on piles secondary to cirrhosis of the liver are usually strongly contra-indicated.

### Occupation Diseases.

**Bleeding.**—There is naturally a special liability to injury of arteries in those engaged in military and naval services. Otherwise all classes are more or less subject to such injuries. Further, those possessing diseased vessels, whether due to syphilis, alcohol, lead-poisoning, and the like, are more prone to contusion or rupture of the diseased vessel, especially if an aneurismal dilatation be already existent. There is also a certain class of people, known as “bleeders,” in whom the slightest injury causes bleeding. (See Children—Vessels, p. 235.)

**Aneurism.**—Aneurism is in part the result of laborious work throwing too great a strain upon weak or diseased vessels. It is in consequence common in those who undertake heavy

manual labour, and is frequently found among soldiers, navvies, etc.

**Varicose Veins.**—Varicose veins are common among women, and are often produced by wearing tight garters, particularly when the wearer has to do a great deal of standing, as in washerwomen and cooks, and persons engaged in like occupations, the erect position exaggerating the backward pressure upon the veins. The condition is often seen after clotting of the pelvic veins at child-birth, forming the well-known condition known as “white-leg.”

### Diagnosis.

The diagnosis of **Hæmorrhage** is made from the outward and visible signs of bleeding, and by the symptoms produced on the patient by loss of blood. Among the more important symptoms of internal or concealed bleeding are collapse, pallid surfaces, a quick, soft pulse—readily compressible—general restlessness, mental delusions, and visual disturbances. The diagnosis as to cure is also important. It should be made not only on a general review of the patient’s condition, but also on the blood-examination, for the microscope offers an infallible guide to the constituency of the blood, the number of blood-corpuscles and their colour being capable of estimation.

### Aneurism.—

The diagnosis of an aneurism of the extremities can usually be arrived at without any very great difficulty. The points to which attention should be mainly directed are as follows: A pulsating tumour in the course of an artery, the “bruit” heard by the stethoscope, the cessation of pulsation on compression of the artery above, and symptoms resulting from pressure on surrounding organs.

In some few cases other pulsating tumours render diagnosis more difficult.

### Malingering.

**Bleeding.**—The possibility of simulation of bleeding by the exposure of garments or bandages stained in animals’ blood or dye, the expectoration of crimson saliva (betel-chewing), etc., can always be detected by careful examination of the person, by washing of the region from which the supposed hæmorrhage is taking place, and by the chemical and microscopical examination of the fluid.

**Varicose Veins.**—A considerable number of cases appear

before the Courts of persons who claim that they are suffering from an injury in connection with varicose veins, the sufferer alleging that an injury has caused bleeding from varicose veins, especially when an ulcer is formed on the course of the veins. These ulcers often bleed spontaneously, without any accident at all, and, as no complaint may have been made at the time of the alleged accident, the Judge will have to decide upon the evidence as to whether or not the accident did occur.

### Criminal and Self-inflicted Wounds.

Hæmorrhage is probably the most common cause of death in all homicidal and suicidal wounds—*e.g.*, cut-throat, stabs, etc. Reference should be made to the articles dealing with these and other similar subjects (*e.g.*, Throat, p. 807, etc.).

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## LYMPHATICS.

### Head-note.

Direct injury to lymphatics is of little consequence except in the rare cases where the lymphatic duct is injured. But as indicators of the source of poison circulating in the body the lymphatic glands are of enormous value.

### Technical Terms.

(See Vessels.)

*Chýľ.*—The lymph after it has collected some of the products of digestion from the intestines.

*Lýmph.*—The clear fluid which moistens all the body vessels, and which aids in both absorption and excretion.

*Lýmphatic Glands.*—Small nodules, usually of about the size of a pea or a little larger, which are arranged along the course of the lymphatic vessels. (See below, Anatomy.) [Figs. 200-202.]

*Lýmphatic Vessels.*—The thin-walled channels containing the lymph. (See below, Anatomy.) [Figs. 200-202.]

### Anatomy and Physiology.

All the cells of the body are brought into close connection with the capillaries of bloodvessels (see Vessels) or those of lymph vessels. Lymph vessels possess extremely thin walls, and convey the fluid lymph from the blood and tissues to the large duct which opens into the big vein at the root of the neck. The channels closely resemble veins in general forma-

tion, and are provided with valves. [Cf. Figs. 197 and 200.] In the abdomen they collect part of the products of digestion from the intestines, which in consequence makes the clear lymph milky, and it is then called "chyle." This is conveyed to a large duct—the thoracic duct—which empties into the large vein at the root of the left side of the neck. The lymph vessels from the right side of the chest, head, and neck open by a separate trunk into the bloodvessels at the right side of the neck. Arranged along the course of the lymphatics, as they collect lymph from all parts of the body, are numerous lymphatic glands. Groups of these glands are regularly found in situations that are well known to the anatomist, and the lymph which drains through them is practically always collected from a definite area for each group. For instance, there is a set of these glands in the groin, into which passes the lymph collected by the lymph vessels from the skin of the lower part of the abdomen, the whole of the front and inner side of the leg, and part of the external genital organs. This is well shown in the illustration. [Fig. 200.] In the event of any inflammation occurring, the poisoned products of bacteria infect the lymph, and are carried by the lymph vessels to their own special set of glands. The glands become enlarged and tender, and to some extent retard and prevent the further spread of the bacterial poisons. At all events, when the surgeon discovers a swollen gland, he is enabled to form a definite opinion as to where to search for the cause.

### Consequences of Injury.

It is quite impossible for any injury to be strictly confined to lymphatic vessels, great or small, for arteries and veins in the immediate neighbourhood of the injured lymphatics must be injured at one and the same time. The symptoms arising from injury to arteries and veins greatly predominate, and the treatment is practically confined to treatment of the injured bloodvessels.

The lymphatic glands of the body, as has been mentioned under Anatomy, frequently enlarge in consequence of infection. It is often claimed that the injury is the cause of this enlargement. It is very doubtful if anything of the kind ever happens, unless the tissues drained by the glands in question have been infected with poisonous organisms at the time of the accident or at a subsequent date.

For injury to the thoracic duct, see below, Disease.

**Disease.**

1. **Caused by the Accident.**—The swelling of the tissues (œdema) alluded to under Disease of Veins is more marked and more chronic when the lymphatics are also obstructed. Injury to the main lymphatic duct in the neck leads to loss of “chyle,” with weakness, wasting, and perhaps death.

2. **Existing before the Accident and aggravating its Effects.**—Enlarged glands in the groin, which are usually the consequence of venereal disease—popularly known as “buboes”—may be injured by an accident, and so made worse.

**Operation.**

Glands inflamed, and which contain matter, must be opened.

With regard to injury to the thoracic duct, operation is seldom needed. The wound is plugged in the hope that various anastomotic channels will remedy the defect.

**Cure.**

**Return to Work.**

**Recurrence.**

**Occupation Diseases.**

} There is nothing special to note here.

**Diagnosis.**

The diagnosis of an enlarged gland from a hernia should not cause any difficulty, but the mistake has been made.

**Malingering.**

It is often claimed that an enlarged gland in the groin results from accident. Careful examination usually reveals that such glandular enlargements are in reality “buboes”—*i.e.*, are secondary.

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*For legal cases of Injury to Vessels, Arteries, Lymphatics, and Veins, see CASE GUIDE : Vessels.*

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**WOMB.**

*See GENITAL ORGANS—FEMALE.*

# WOUNDS OF THE SOFT PARTS.

BY THE LATE RUPERT BUCKNALL,

M.D., M.S. (LOND.),

Surgeon, University College Hospital; Lecturer on Surgery, University  
College Hospital Medical School.

## Head-note.

THE chief evil consequences of injuries to the soft parts are—

- (a) Bleeding (hæmorrhage). (See Vessels, p. 833.)
- (b) Anæsthesia or paralysis (interference with sensation or motion) where the nerves are involved. (See Nerves, p. 572 *et seq.*)
- (c) Infection of the wound, leading to secondary infections in other parts of the body, which may prove serious, or even fatal. (See Infection, p. 436 *et seq.*)

## Technical Terms.

*Åbråñion.*—An injury involving the loss of the superficial layers of the skin or of a mucous membrane, but not destroying the deeper layers on which the growth of new skin depends. Unless infected by microbes, an abrasion should heal without a scar.

*Bruise.*—In a bruise the tissues are pulped by a blow, rupturing the small vessels, and sometimes rupturing a large one. This leads to bleeding into the injured tissues, which consequently swell and become discoloured by the colouring matter of the effused blood. If the bleeding is in the skin, the discoloration appears almost immediately, and is bright red at first. If the bleeding is in the tissues under the skin (subcutaneous tissues), the swellings and discoloration do not appear until later, and the bruise is dark blue rather than red. The interval between the blow and the appearance of the discoloration depends on the depth of the bleeding below the surface. (See below, Bruising.)

*Cåpillårý.*—The capillaries are the smallest of the bloodvessels. They are of microscopic size, and form the communicating link in the circulation of blood from the arteries to the veins, for the blood



enters the capillaries from the arteries and flows out in the veins. (See Vessels.)

*Ēchġmōsis*.—A bruise which is chiefly in the superficial layers of the skin, the appearance being produced by bursting of some very small bloodvessels.

*Ēpithēlium*.—The cells which form the external skin and the internal skin (mucous membrane). In simple English, epithelium may be translated as the surface of the external or internal skin. It also includes glands and their ducts.

*Graft*.—A piece of skin of various sizes and thickness, but usually small, and always of the thinnest nature. It is cut from part of the body, and grafted by the surgeon on to a raw surface from which the skin had been removed by disease or accident. New skin starts growing from the graft. Grafting is frequently done to accelerate the rate of healing of large raw surfaces.

*Hæmōrrhāge*.—The scientific term for bleeding, whether from a wounded artery, vein, capillaries, or all three together.

*Hæmātōma*.—A blood-blister or a blood-tumour common in the skin as the result of an injury.

*Infection*.—The access of microbes to the body, producing a deleterious effect; the entry is commonly made through a wound or other injury. This condition of infection is very prone to arise in those cases of injury to the skin and soft parts now under consideration. When it occurs it renders the results of such injuries far more serious than they otherwise would be. This will be discussed below under Consequences of Accident. (See also Infection, p. 436 *et seq.*)

*Lġmphātġcs*.—In addition to blood there is a clear fluid, which is derived from the blood, and which flows in regular canals. These canals are called "lymphatics." At intervals along their course are placed numerous small nodules which vary from the size of a pea to a small bean; these are called "lymphatic glands." [Figs. 200-202.]

*Mucous Membranes*.—The moist skin that lines the internal part of the body and the canals (or passages) from hollow organs.

### Anatomy.

The various structures which may be wounded include—

(a) The external skin covering the exposed surfaces, and internal moist skin (mucous membranes), which are both many-layered sheets of growing (epithelial) cells, resting on, and deriving their nourishment from, a layer of tissue which lies immediately beneath them, and which is especially well supplied with blood.

(b) The tissues subjacent to the skin—"subcutaneous tissues," connective tissue, and fat—which fill in the space between the skin, muscles, bones, and fasciæ.

In these "subcutaneous tissues" are numerous blood and lymphatic vessels, nerves, and (in certain regions) lymphatic glands, all of which may be involved in cases of injury.

### Consequences of Accident.

The consequences of accident to special parts of the body comprise most of the other sections of this book, in which they are arranged alphabetically.

1. **To the Skin and Mucous Membrane.**—(See Skin, p. 709 *et seq.*)

(i.) **Bruise.**—If the skin or mucous membrane is bruised, a bright red discoloration appears almost instantly in the area struck.

During the course of the first twenty-four hours the discoloration changes to a deep blue or purple black. In about three to six more days the effused blood begins to be absorbed, the blueness fades, and a yellowish staining remains.

A bruise which is limited to the skin or mucous membrane alone spreads but little into the parts around, and then chiefly in a downward direction under the influence of gravity. For the contrast in wounds of the soft parts, see below. In cases of severe bruising the blood may accumulate in or beneath the skin so as to form a blood-blister (*hæmatoma*), and the blood thus effused may become infected so as to form an abscess.

(ii.) **Abrasion.**—In this injury part or the whole of the thickness of the upper layer of the skin is removed in consequence of a blow or a fall on a rough surface. A superficial burn or the application of caustics may also destroy the surface layers of the skin and produce a condition resembling injury.

There are two degrees of abrasion :

(a) In which the superficial layers of the skin alone are removed or damaged. The deeper layers meanwhile remain intact, and soon fill in the deficiency, leaving no scar.

(b) In which the whole thickness of the skin is completely destroyed, so that no epithelial cells remain over the injured area capable of forming a new skin. In such a case the wound heals slowly, and, unless a graft of skin is applied by the surgeon, the cells to cover the denuded area grow over from the healthy skin surrounding the margin of the wound. The process of healing is accompanied by the formation of an excess of fibrous tissue, which shrinks, leaving an obvious scar. This scar does not disappear, and if extensive is likely to contract afterwards and cause deformity, more particularly when on the face.

(iii.) **Open Wounds.**—Wounds of the skin and mucous membranes may be punctured, incised, lacerated, or ragged; and may be accompanied or not accompanied by bruising, according to the force used and the form of weapon employed. Punctured or incised wounds, if not infected by microbes, heal well and leave little or no scar. If infected, however, they heal more slowly, and scarring is prone to ensue. Ragged and contused wounds always heal slowly, and are likely to leave scars, for the reason that they are peculiarly liable to become infected through the dust that is often introduced at the time of the accident. Afterwards, during the long period of repair, microbes may infect the wound. In either case of infection a further destruction of skin occurs which delays healing and leaves scars.

2. **Injuries to the Parts under the Skin.**—(i.) **Bruise.**—Blows with blunt instruments, severe compression, suction, and heavy blows with sharp or blunt instruments, may all cause such an amount of damage of the tissues under the skin, and injury to the bloodvessels, that the blood they contain escapes into the surrounding tissues.

The amount of blood poured out varies with the severity of the force acting, the size of the area injured, and the degree of vascularity of the part affected. It also depends upon whether the vessels injured are arteries, veins, or capillaries.

In a slight bruise, only a small amount of blood escapes into the tissues, there is but little swelling, and the discoloration is not very marked.

In more severe examples more blood is effused, and the swelling, discoloration, and destruction of the tissues are more marked. In the most severe cases, where vascular areas or larger arteries or veins are injured, a definite tumour of blood under the skin (subcutaneous hæmorrhage or hæmatoma) may be formed.

The discoloration that is caused by a bruise which chiefly injures the deeper tissues and soft parts differs in several ways from that seen when the skin itself is alone bruised. (See Diagnosis.)

It does not appear at once, but takes hours, days, or even weeks, to appear on the surface. The periods depend on the depth beneath the skin at which the bruised tissues lie, and also on the permeability of the tissues through which the blood pigment has to make its way before reaching the surface and skin.

Unless the *skin* is also bruised, the discoloration is not a bright red, but a dull blue or black. These colours slowly intensify, changing to a yellow, and disappear very gradually. The staining in this case, when the deeper parts are injured, tends to spread downwards, under the influence of gravity, to areas considerably below those originally injured. The slow appearance of discoloration in bruises to the deeper layers of the soft parts, and the tendency to spread downwards from the spot struck, have to be taken into consideration in estimating the site and severity of an injury. A blow on the abdomen may cause a bruise to appear weeks later, and by that time as low down as on the thigh.

Hæmorrhage (arterial, venous, or capillary) may occur into the tissues under the skin and into the soft parts as the result of compression or of a blow with a blunt instrument, even where there is no actual external wound.

If the vessels be thus opened, the internal bleeding may give rise to serious symptoms—viz., collapse, fainting, shock—or it may even prove fatal.

(ii.) **Open Wounds.**—Wounds of the soft parts may be punctured, incised, clean-cut, lacerated, ragged, or contused, according to the part involved and the nature of the instrument used. The bloodvessels and the lymphatic vessels may be cut or injured.

In any case, should infection of the wound occur, the organisms and their poisonous products (toxines) are apt to spread to the neighbouring lymphatic glands. These glands will then inflame, and the poison, passing on to the blood-stream, will cause general septic poisoning of part or the whole of the body. (See Infection, p. 436 *et seq.*)

Blood collected in the bottom of a wound, or actual loss of tissue, or septic infection, will delay the normal healing processes, and lead to the formation of a scar, which at first merely closes in the wound, but later on contracts.

As scars always tend to contract in all directions, they leave an unsightly depression or deformity of the affected area by pulling the skin and the surrounding structures out of their proper place. In other instances the scarring binds together the deeper structures, fixing them immovably. (For painful scar see below, Disease.)

#### Disease.

I. **Caused by the Accident.**—(a) **Scar.**—Any severe abrasion, bruise, or wound of the skin and tissues may only heal with

considerable scarring, and even after long and careful treatment leave the parts permanently painful and crippled.

*Painful Scar.*—A painful scar may result from a wound to any part of the body, and may arise from one of two causes, of which the commoner is the nipping of the nerves supplying the injured part, during the contraction of the hard fibrous tissue forming the scar—a contraction which is usual in the process of healing where much fibrous tissue is formed.

The other cause of pain is inflammation of the nerves of the injured part, occurring after the injury.

Both of the varieties of painful scar are limited, and do not commonly spread beyond the area of the wound.

If the nerves be not affected, any considerable wounds may heal with large scars without pain; but if a few fibres of a nerve be implicated, any wound, no matter how small, may heal and leave a painful spot.

(b) *Keloid.*—See Skin, p. 716.

(c) *Infection.*—An infection of the part injured may spread to the adjacent tissues, and lead to their inflammation and partial or complete destruction, thus increasing the area and evil effects of the scars.

The organisms of infection may be carried by the lymphatic vessels from the wound to the nearest lymphatic glands, causing them to inflame and break down into an abscess; or the organisms may gain access to the general blood-stream of the body, and so set up pyæmia, septicæmia, and other kinds of general infection, which are most serious illnesses, and frequently fatal. (See Infection, p. 436 *et seq.*)

2. **Existing before the Accident and aggravating its Effects.**—Almost any affection of the skin—for example, a boil or eczema—may be rendered worse if the affected area is in any way abraded, bruised, or wounded.

A man with rheumatic and gouty affections of the soft parts, and with tissues previously swelled or inflamed, would also suffer more extensively and for a longer period than a healthy individual.

If the walls of the arteries were hardened by disease, then there might be clotting inside them, or bleeding might take place as a result of an injury, which would give rise to no such trouble in a person with sound vessels. The same complications might ensue if the veins were injured in an individual whose veins were varicose. (See Vessels at p. 840, Fig. 198.)

Any infected spot in any other part of the body may lead to

the infection of the injured region, whether abrasion, bruise, or wound, and so delay the healing and cause further destruction of the surrounding tissues.

Individuals with tuberculosis in their system may develop a new tubercular spot in a trifling wound, which would have healed at once in the healthy.

Injured persons subject to hæmophilia are likely to bleed more severely than healthy individuals. In a sufferer from Bright's disease, diabetes, gout, or any other general defect in health, especially alcoholism, a wound is more easily infected, and repair takes place more slowly than in a normal subject.

### Operation.

An operation may be needed for the following purposes :

- (i.) To stitch together the edges of the wound.
- (ii.) To graft skin.
- (iii.) To tie bloodvessels.
- (iv.) To let out the blood in cases where collections of blood have formed in the deeper tissues.
- (v.) To relieve tension of the skin caused by inflammatory swelling, and afford egress to the matter (pus) collected in the wound, and afterwards enable the wound to be disinfected.
- (vi.) To correct the disfigurements, deformities, etc., in cases where scarring and contractions have followed injury.

The actual operative procedures employed in cases of this kind are so slight, and the parts operated on are usually so simple in structure and easy to reach, that the only risk to be mentioned is that which may arise in connection with the administration of the anæsthetic. (See Anæsthetics, p. 70 *et seq.*) There is some slight risk of infection in the operation wound but with due precautions this should be entirely eliminated.

(vii.) To cure a painful scar. (a) The scar may be entirely removed, and the edges of the wound stitched together to promote rapid healing and to avoid another scar ; (b) the nerves which supply the painful spot may be cut.

Whenever these operations are possible of performance, they are usually of quite a trivial nature.

### Cure.

I. **After Injuries of the Skin.**—Abrasions of the skin take about ten to fourteen days to heal, and should leave no evil after-effects.

Bruising of the skin takes about three weeks for complete recovery, unless infection has occurred, when the time needed would be much longer.

Incised wounds of the skin, unless they become infected, should be healed and well in less than a fortnight.

Wounds of the skin with loss of the whole tissue are more serious, and some months may elapse ere skin completely covers over the part again.

An operation for skin-grafting may be necessary, but in any case, even after healing has occurred, there probably will be a scar remaining.

The scar may contract, distorting and interfering with the proper movement of the parts involved.

**Painful Scar.**—Painful scar does not as a rule improve unless operated upon. The pain does not usually recur after operation, and the patient should be well in about a week.

2. **After Injuries to the Soft Parts.**—Bruising of the soft parts, if slight, should clear up in about a month and leave no ill-effects.

If more severe and extensive and particularly deep in the tissues, the length of time for the disappearance of the bruising may be prolonged for months or more. There is then a tendency for scarring to occur and remain in the deeper tissues, and cause prolonged or even permanent disability.

A simple wound of the soft parts—*i.e.*, not lacerated—not involving one of the larger vessels or nerves, and which does not become infected, should heal in from ten to twenty days.

### Return to Work.

1. **After Injuries to the Skin.**—The interval that must elapse after due healing of abrasions, bruises, and wounds, before the injured individual can resume work, varies in different cases, and its length is influenced by the following factors :

(a) Whether the injured part is one which the injured individual actually employs, and must employ, to do his work. For instance, a small bruise or abrasion of the right forefinger of a clerk would need a longer interval of rest than a much more severe lesion on his arm or body. A minute injury to a postman's foot would keep him from work longer than a similar one on any other part of his person.

(b) Whether or not the injury has been of sufficient severity to lead to scarring and contractions. Slight wounds heal

readily, and as soon as surgical cure is complete the man may return to work. (See above, Cure.)

Such scarring, if it occur in connection with a part which is used in working, may either temporarily or permanently prevent a man returning to work at his former trade. Thus, a pianist with a slight scar of the skin of the finger may be incapacitated when an ordinary workman could resume his work. Each case must be considered on its individual merits, respect being had to the degree of the injury, to the severity of the after-results, and to whether or not the part injured is the one particularly used in the injured man's work.

2. **After Injuries to a Nerve.**—See Nerves, p. 572 *et seq.*

3. **The Parts under the Skin.**—What has been said above with regard to the skin applies equally to the soft parts, for the period of rest which may have to intervene between the complete surgical healing of the injuries and the complete disappearance of the after-effects, with perfect restoration of function, is influenced by the same factors.

If a large bloodvessel has been severed in a limb, the resultant want of circulation may persist, and the proper use of the limb may never be recovered. This is especially so in the legs.

### Recurrence.

As a rule, the various lesions that result from injuries to the skin and soft parts either persist unchanged or clear up, and do not tend to recur.

Scars at times become painful, or show a tendency to eczema or keloid, particularly when exposed to superficial irritation. (See Skin, Keloid, p. 716.)

Scars resulting from wounds which have been infected are specially susceptible to reinfection, and so may break down later, either from no obvious cause or from the result of trifling injury or irritation.

### Occupation Diseases.

1. **Of the Skin.**—See Skin, Occupation Diseases, p. 734.

2. **Of the Soft Parts.**—The nerves running in the soft parts may be affected in certain occupations, and paralysis or loss of sensation may result, according as they are sensory or motor. (See Nerves, p. 572 *et seq.*)

In certain occupations where the parts are exposed to severe and repeated pressure, the normal fat under the skin (subcutaneous tissue) may grow so as to form a fatty tumour.



The lymphatic spaces known as "bursæ," in the tissues overlying various prominent bony points in different parts of the body, may in certain occupations be subjected to too much pressure, and, becoming distended, may form painful swellings, which may prevent work and are always liable to become infected and form abscesses. (See Bursæ, p. 196 *et seq.*)

### Diagnosis.

The diagnosis of many cases of injury ascribed to accident presents peculiar difficulties for the following reasons: The history can only be obtained from the patient, who may be an imperfect observer, or may definitely attempt to deceive, and in the absence of corroborative evidence this history is of little value.

Certain diseases so closely resemble the effects due to injury that the observer may be deceived, especially where a definite history of injury is given.

The patient may be a malingerer complaining of symptoms which do not exist, or he may have produced the visible signs of injury upon himself.

It is important to note these various difficulties, in order that errors in diagnosis may be avoided. The history given should be carefully examined, and the manner of the accident compared with the effects ascribed to it.

In bruises, wounds, and scars, the time that has elapsed since the injury occurred can be calculated with some reasonable degree of certainty.

The patient may give a history of an accident which he says happened at a date quite incompatible with the condition of the injured part.

When there are only complaints, without any changes or signs in the body which the medical observer can detect, it is necessary to study in detail the alleged symptoms, and it is often possible to notice that, in addition to symptoms that the injury might have caused, others are added which could not possibly have been caused by the alleged injury.

Eczema and various other skin diseases, when localized, may be referred to as the results of burns and injuries.

Bleeding (hæmorrhage) arising from a spontaneous rupture of a varicose vein may be attributed to a blow, and so may the inflammatory swelling of the leg arising from varicose veins. Hæmorrhages into the skin and soft parts in sufferers from hæmophilia may be falsely ascribed to injury.

**Scurvy.**—This produces bleeding under the skin, which resembles a bruise; but the characteristic of scurvy is, repetition of bleeding of this kind. Apparent bruises come out day after day, and go through the usual changes, so that a man who suffers from this disease will soon have marks on him resembling very recent, recent, old, and very old bruises. In addition, the gums are also swelled in this disease.

### Malingering.

Malingers are of two types. The one describes symptoms only, and attributes them to the accident; the other manufactures lesions and visible deformities in his own person to imitate the results of injuries. Genuine wounds resulting from accident are artificially kept open and not allowed to heal. Should they be completely covered in by some impervious dressing by the surgeon so that healing occurs, the malingerer will cause a similar sore on some exposed part of the body, and ascribe it to some other accident.

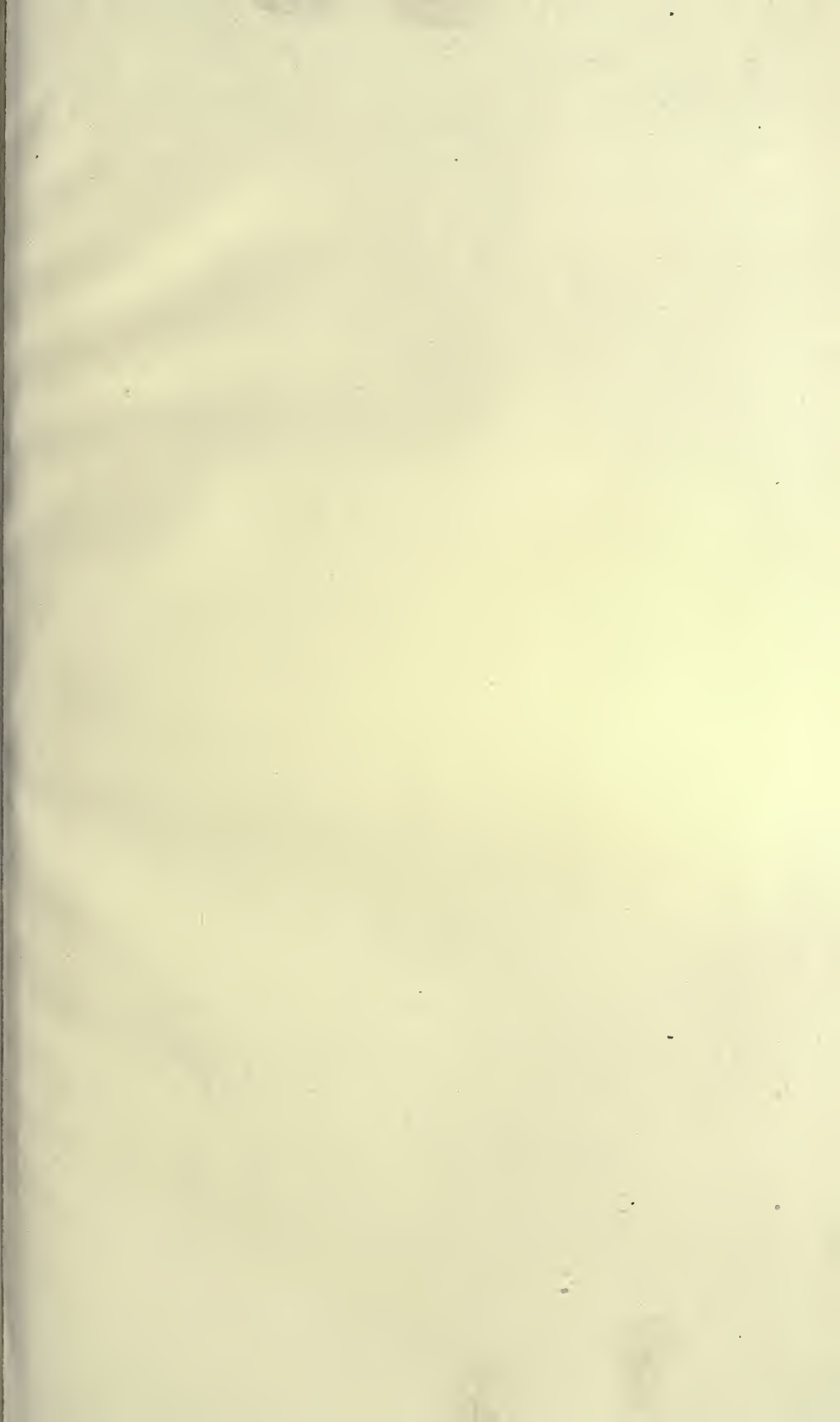
The malingerer who describes symptoms only can usually be detected, because he mentions some which could not possibly be caused by the particular kind of injury claimed to be responsible for their origin.

The bruises and wounds produced by the man himself are in curious situations, are usually slight, and do not correspond in shape and other features to the reported mode of production. Incapacity to recover after injury may be produced by the man's own irritation of his wound or bruise.

Pain and loss of sensation, when complained of by the malingerer, do not correspond in their distribution about the body to the area supplied by the particular nerve that would be affected if the injury was as alleged. (See Nerves, Figs. 141-144 and p. 574.)

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*For legal cases of Wounds, see CASE GUIDE: Wounds.*





# THE X RAYS.

By C. M. HINDS HOWELL,

M.D. (OXON.), M.R.C.P.,

Physician to Great Northern Central Hospital; Late Registrar, with charge of Electrical Department, of the National Hospital for Paralysis and Epilepsy.

## Head-note.

THESE are rays of light produced under certain circumstances, which have the power of penetrating, more or less completely, most opaque objects, some of the metals excepted.

## Technical Terms.

(See also Electrical Injuries.)

*Atom.*—The smallest particle into which any known substances (except ether) can be divided. The difficulty of understanding an atom is complicated by the assertion that they cannot exist alone, and two or more are always united as “molecules.”

*Atomic Weight.*—Hydrogen is the lightest known substance, and is taken as the chemical standard of weight. All other chemical substances are weighed by the standard of hydrogen. For example, oxygen is nearly sixteen times as heavy as hydrogen. These figures are known as the atomic weights, that of hydrogen by 1, and oxygen by 16. It is called “atomic” as being the relative weight of the smallest possible quantity—an atom.

*Électrôn.*—See X Ray.

*Éther.*—A substance in the nature of an extremely thin gas, not susceptible to weight or analysis at present, but whose existence is implied as a necessity to account for a substance which can convey vibrations of light from the planets and of heat from the sun. It is said to penetrate universally between the smallest particles, “molecules” (combined atoms) of which matter is composed, and to fill a space which is emptied of air, a vacuum. (It is nothing to do with the ether of anæsthesia.)

*Käthöde Rays.*—These consist of minute gaseous particles smaller than atoms, and called “electrons.” They are electrically charged.

*Mölcule.*—See Atom.

*X Rays.*—These are vibrations of definite wave-length in the “ether,” and thus very different to kathode rays.

*X-Ray Tube.*—A glass vacuum tube through which a current of electricity is passed in order to excite it, and so produce X rays. Two metallic electrodes are introduced within the tube to form an anode (or positive pole) and kathode (negative pole) for the electric current. The kathode consists of a concave disc from which kathode rays are reflected. These fall on a third piece of metal within the tube, and are reflected from this on the walls of the tube. When the kathode rays impinge on the glass of the tube they give rise to X rays.

### Nature of Rays.

These were discovered by Röntgen in 1895. He passed an electrical current through a vacuum tube of glass. Such a tube is called a “Crookes’s tube.” If a current of electricity, either from a powerful induction coil or from a static machine, be passed through a tube of this kind, a greenish fluorescence appears, which is caused by the bombardment of the walls of the tube by negatively charged gaseous particles, which are propelled with enormous velocity from the kathode of the tube. The particles are not minute pieces of the kathode which become detached, but are gaseous in nature. They are much smaller than atoms, and are termed “electrons.” They constitute what are known as “kathode rays.”

When the kathode rays strike any solid object, their extremely rapid course is brought to a standstill, and it is this sudden arrest which gives rise to vibrations known as “X rays,” which are vibrations in ether, and therefore very different from kathode rays.

X rays have the property of exciting fluorescence in certain chemical substances, as uranium tungstate and platinocyanides of barium and potassium. They act on sensitive photographic plates in the same manner that light does, and they will penetrate opaque bodies more or less completely, according to the atomic weight of the body; the higher the atomic weight the more opaque the body becomes.

An important factor affecting the penetration of the X rays is the thickness of the material through which the rays have to pass. For instance, they will penetrate a thin man with greater facility than a fat one. The hand is much more easily penetrated than the thigh, the elbow-joint than the hip-joint, and so on.

### Use of the X Rays.

(i.) **For Diagnosis.**—In consequence of their properties, the X rays have been used very largely in surgery and medicine, as by their use the condition of the bones, and to a less degree the soft parts, can be rendered obvious. A shadow of the parts under examination may be seen on a fluorescent screen, or a permanent record may be obtained on a photographic plate. (See below, Diagnosis.)

(ii.) **For the Treatment of Disease.**—X rays are still in an experimental stage, and the limitations to their use as therapeutic agents have not yet been decided. Their value has, however, been established in the treatment of the following conditions, when the rays can fall directly on to the disease :

- (a) Certain parasitic diseases—*e.g.*, the various forms of ringworm.
- (b) Some tubercular conditions—*e.g.*, lupus vulgaris.
- (c) New growths—*e.g.*, various superficial forms of cancer, carcinoma, sarcoma, rodent ulcer.
- (d) Various chronic skin affections.

### Accidental Consequences of the Use of X Rays.

(i.) **X Rays as Direct Cause of Accident.**—When the X rays were first used for clinical purposes, the operators were unaware that prolonged exposure to the rays might produce undesirable results. Consequently no special precautions were adopted either to protect the operator from the action of the rays or to limit the quantity or quality of the rays to which the patient might be submitted. As a result of this accidents of a more or less serious nature resulted.

(ii.) **From the Electricity used to create the X Rays.**—See Electrical Injuries, p. 259 *et seq.*

### Nature of Accident.

Two main types of accident have been found associated with the use of X rays :

(a) **Acute Burn from a Single Long Exposure.**—This, as a rule, develops a few days after the exposure. The skin at first becomes red and inflamed, and subsequently ulcerates, in the more severe cases. The burns heal ultimately, but the skin becomes quite wasted and thin where the burn has been. As a result the various cutaneous structures also waste or atrophy,

and so if the burn has been produced by giving treatment for ringworm on a hairy part, such as the scalp, permanent baldness may be produced.

(b) **Chronic Inflammation of the Skin (Dermatitis).**—This only results among those who are much exposed to the influence of the X rays, and who have not taken precautions to protect themselves from their influence. It is common in those who worked with X rays before their tendency to produce such dermatitis was known, but is less frequently met with in those who have more recently taken up X-ray work. The condition begins as a kind of eczematous inflammation of a most intractable kind. It heals in places, only to break down again shortly afterwards. Ulceration eventually supervenes, and, unfortunately, the chronic irritation may continue till cancer of the skin is produced. This may necessitate the removal of one or both hands. The parts most liable to X-ray dermatitis are the backs of the hands and fingers. Parts covered by clothing are seldom affected.

#### Operation.

Operation may be necessary if cancer develops.

#### Cure.

Cure may be affected by removal from the influence of the rays. A severe X-ray burn will heal eventually, but the dermatitis is most intractable, and will persist for a very long while.

#### Return to Work.

The dermatitis, or burn, does not necessarily prevent work. They do, of course, prevent any further work with X rays, or any work in which the hands, for instance, would be exposed to irritation of any kind.

#### Recurrence.

Recurrence is not likely unless exposure occurs again.

#### Occupation Disease.

This—already considered—may affect those working with X rays.

#### Diagnosis.

(a) **Of an X-Ray Burn.**—In the case of an X-ray burn, or dermatitis, no question is likely to arise. The history of the case will as a rule make the diagnosis sufficiently clear.



X-ray dermatitis only occurs in those constantly working with X rays. With regard to the burns, a prolonged single or series of single exposures will be necessary, and inflammation of the skin, going on to ulceration in the area exposed to the rays, is most unlikely to be anything but a severe burn.

(b) **The Diagnosis of Injury by Means of X Rays and the Interpretation of the Skiagram.**—This is a much more difficult subject, and the interpretation of X-ray photographs requires much experience, and may even then admit of argument. As the negative picture obtained on a photographic plate is simply the “shadow” of the object photographed, it is evident that, like all shadows, it may be more or less distorted.

The amount of distortion and exaggeration will depend—

(a) On the relative position of the tube, the object, and the photographic plate.

(b) On the distance of the tube from the object.

If the tube is so placed that a straight line drawn from its centre passes through the object and makes a right angle with the plate, the distortion produced will be reduced to a minimum. Also, the farther away the tube is from the object, and the nearer the object is to the plate, the less the exaggeration of the shadow produced.

It becomes necessary, then, to know what were the relative positions of the tube, object, and plate, before attempting to interpret an X-ray negative. A further difficulty is caused by the fact that shadows are flat on a plate, and hence it is impossible to state with certainty the relative position in the body of the various objects which throw shadows on to the plate. This difficulty has been, to a certain extent, obviated by the introduction of stereoscopic methods into X-ray photography. It is possible by such means to recognize the relative positions of the various bones, etc., whose shadows are reproduced on the negative.



**PART III**  
**CASE GUIDE**



## CASE GUIDE

### ABDOMEN.

CASES of injuries to the abdomen will be found below, classified under the various organs affected—*e.g.*, kidney, peritoneum, intestines, etc. A violent blow over the abdomen may produce the condition of "shock," described on p. 38. This "shock," which may be fatal, must clearly be distinguished from the legal condition so well known to counsel as "shock to the system"—a phrase which concludes nearly every statement of claim for any bodily injury. (See below; Neurasthenia, which is possibly the condition intended to be described.)

### AGE—OLD AGE.

(FOR INFANCY, SEE CHILDHOOD.)

The legal capacity of the old man is the same as that of the young man, unless some mental change common in old age supervenes and renders him partially stupid, such as the condition of "senile imbecility," which is a form of insanity (*q.v.*).

Certain physical changes occur in the body after middle life, particularly in the circulatory system, which may render the effects of accident more serious than in the young. Hardening of the arteries (atheroma) is perhaps the most common of these changes, for cases of which see Brain, Heart, etc.

In a claim for damages or compensation, it is no defence to allege that the presence of these senile conditions has enormously increased the effects of an otherwise trivial injury.

Under the W.C.A.; as long as incapacity due to injury remains, so long is the master liable to pay compensation; but whether or not the present incapacity is due to old age or to the injury is a question for the arbitrator to decide.

#### **Incapacity to Work due to Old Age, and no longer to Injury.**

*Incapacity due solely to Old Age* (W.C.A., Scottish).—On April 13, 1900, the workman was injured by falling 24 feet, which produced concussion of the brain and fractured pelvis (haunch-bone). On April 24, 1901, acting under Schedule 1 (11), W.C.A., 1897, which in this respect is identical with Schedule 1 (15) of 1906 Act, the medical referee certified as follows:

"I hereby certify that his condition is as stated below. He has

recovered from the above-mentioned injuries, and his condition is such that he is fit for light work. In my opinion he will never be able to do hard manual labour, but only fit for light employment. This disability is *not connected with his late injuries*, but is the result of deficient natural vigour of constitution, together with advancing years."

THE LORD JUSTICE-CLERK: "The certificate of the medical practitioner appointed by the Secretary of State, that the respondent has recovered from his injuries, and is not suffering from any disability caused by the injuries, is conclusive against any further claim for compensation under the Workmen's Compensation Act."

LORD TRAYNER: "The Act provides that where 'total or partial incapacity for work results from the injury' the workman is entitled to a certain weekly payment 'during the incapacity'—that is, the incapacity resulting from the injury. . . . But the employer is not to provide compensation for an incapacity not connected with or caused by the injuries received in his employment."

[*M'Avan v. Boase Spinning Company*, 1901, 3 F., 1048.]

### Old Age is not a Reason for Reduction of the Amount of the Weekly Payments

*Blind Workman becomes Too Old for Full Work* (W.C.A., Scottish)—Many years ago, workman lost use of left eye, but continued his work as a miner. In 1900 he lost nearly all sight in the remaining eye, and was in consequence awarded compensation at the full rate. On an application to review it was proved that the appellant, who was sixty-four years of age, was incapacitated from work in consequence of his injuries, and not through physical deterioration due to age, but that a miner above sixty-three years of age does not usually earn the maximum wage. Further, there had been a large reduction in the wages paid to miners since the appellant sustained his injuries.

THE LORD PRESIDENT: "Subsequent and extrinsic circumstances of this kind are not relevant to affect the award."

LORD M'LAREN: "Where, on an application for review, you have to consider wage-earning capacity, that is a thing which may vary from time to time, and if this were a question of wage-earning capacity it might be right for the arbitrator to consider the present rate of wages. But there is no question of wage-earning capacity in the present case, because the workman is blind and unable to earn any wage, and not likely ever to do so."

[*Jamieson v. Fife Coal Company*, 1904, 5 F., 958.]

*Blindness and Old Age* (W.C.A., County Court).—A workman at the time that he lost his sight by accident was sixty-nine years of age, and was awarded full compensation. This was an application to reduce the amount, on the ground that, on account of his age at the time of the application, if he were employed at all, he would be earning considerably less than he was earning at the time of the injury.

His Honour refused to reduce the award.

[*Smith v. Hughes*, Carnarvon C.C., Judge Liley; 8 W.C.C., 115.]

## ALCOHOL.

The persons suffering from alcoholism are here classified in three groups.

The first form is chronic alcoholism, which is the condition of a man who (although possibly sober at the time) is diseased or affected by the cumulative results of previous indulgence in alcohol.

The second form is delirium tremens, which is an incident of the first form.

The third form is acute alcoholism, or drunkenness.

## Chronic Alcoholism and Delirium Tremens.

The chronic alcoholic must be regarded as a healthy man from the point of view of the one who injures him. This is the only logical conclusion to be drawn by analogy with the numerous cases of injury to a diseased man, a subject which is fully discussed above under Disease existing before the Accident and aggravating its Effects (p. 22).

Even if a threatening attack of delirium tremens is precipitated or brought on by an accident, so that the injury, as is common, causes the attack, which may or may not be the first, it is submitted that the person causing the injury will be liable for the result, as being the natural and probable consequence of injury to that alcoholic man.

During an attack of delirium tremens a man must be regarded as insane.

The diseased state of a dead man is not relevant to the issue in a claim for damages caused by an accident, if, in fact, it accelerated the date of death, even although the disease was caused by alcohol, and would have shortened the life.

*Alcoholic Disease—Accident* (W.C.A., County Court).—A man met with a fatal accident, and was found at the post-mortem with his brain, liver, and stomach, in a diseased state due to chronic alcoholism. This condition was no bar to his dependants, who recovered compensation as if he were healthy. It was held that his condition was consistent with his continued existence and capacity for work, and that the accident caused the death at an earlier period than that at which it would probably otherwise have happened.

[*Connell v. Barr*, 1903, 116 L.T.J., 127.]

## Acute Alcoholism—Drunkenness.

A drunken man is entitled to the full protection of the law as much as if he were sober.

“If a man is lying drunk on the road, another is not negligently to drive over him” (Coleridge, J., at p. 445).

[*Clayards v. Dethick*, 12 Q.B., 439.]

The criminal law on the subject of the drunken man's criminal responsibility need not be discussed here, though it was fully dealt with in *Rex v. Meade* by Darling, J. (1909, 1 K.B., 898).

### Negligence.

*Acts of Drunken Men—Negligence or Trespass.*—The acts of a drunken man cannot be excused because of his alcoholic condition. Even insanity is no excuse for trespass or even negligence. A drunken man, guilty of negligence, cannot plead his condition as an excuse. "Whenever one person receives an injury from the voluntary act of another, this is a trespass, although there was no design to injure. If a lunatic hurts a man he shall be liable for trespass."

[Weaver v. Ward, Hobart, 124.]

*Employment of a Drunken Servant—Negligence.*—"A cornfactor was absent from his shop, and during his absence his sister managed his business. She wanted to send out some corn to a customer, and for this purpose she employed a person who occasionally worked for her brother, and who at the time of such employment was in a state of inebriety. This man (contrary to the practice of a cornfactor's shop) took out the corn on a small warehouse truck, which he negligently left in the road, whereby a person driving along in a chaise was injured. The cornfactor was held liable in an action at the suit of this person, on the ground that the employment of a tipsy man was an act of negligence, and that by such employment he set the whole thing in motion, and must therefore be answerable for the consequences."

[Wanstall v. Pooley, Lord Brougham, 1841, 6 Cl. and F., 894.]

*Death due to the Intoxication of the Deceased—Negligence.*—This was an action brought by Michael McCormic for damages for the death of his son Joseph, who had entered the train of the defendants in a state of intoxication. His condition was quite apparent to the railway servants, and when the train arrived at his destination he was "prostrated and quite helpless."

The railway officials laid him on the platform and left him for the night. The next morning he was found dead on the line, his body showing that he had been run over.

LORD TRAYNER: "I think it is no part of the duty of a railway company to look after drunken passengers after they have been carried to their destination."

Held: "A railway company is not liable for damage for failing to see an intoxicated passenger safely off the platform at which he arrives."

[McCormic v. The Caledonian Railway Company (Scottish), 1904, 5 F., 362.]

*Drunken Passenger on a Tramcar—Negligence.*—A woman carrying a child was seated on the top of a tramcar, when a drunken man came and stood near her. Losing his balance, the man, to save himself, caught hold of the woman and pulled her backwards; they all fell over the end of the car, the woman sustaining severe injuries and the child being killed. . . .

. . . The jury found that the car was overcrowded; that the man was allowed to get up when he was obviously drunk; that the accident was due to the negligence of the conductor in allowing the car



to be overcrowded, and in allowing the drunken man to get up; and that there was no contributory negligence on the part of the woman. The jury gave the plaintiffs £200 damages.

LORD ESHER, M.R.: "After the evidence of several persons, who said that the man was so drunk that anyone could see it, it was idle for the defendants, after a hearing before the jury and the Divisional Court, to come to the Court of Appeal and to argue that the jury were not justified in finding that he was obviously drunk. As to how the accident happened it was waste of time for the defendants to come and say that the jury were wrong. If the conductor did not see the drunken man go up on to the top of the car, he ought to have seen him go up. If he was inside collecting fares, the company ought to have as many servants as were necessary for the purpose of saving the passengers from unreasonable risks. The defendants failed on every point, and the judgment must be affirmed."

[*Murgatroyd v. The Blackburn and Over Darwen Tramway Company*, on appeal (from the Liverpool Assizes, Denman, J.) before Lord Esher, M.R., Bowen and Fry, L.JJ., 1887, 3 T.L.R., 451.]

### Contract.

The contractual liability of a drunken man may be important in considering if his signature to an agreement under the Workmen's Compensation Act is binding on him or not (*Hall v. Warren*, 9 Ves., 605).

"The modern rule, however, as to the contract of a lunatic or drunken man, who by reason of lunacy or drunkenness is not capable of understanding its terms or forming a rational judgment of its effects on his interests, is that such contract is voidable at his option, but only if his state is known to the other party. The defendant who sets up his own incapacity as a defence must prove not only that incapacity, but the plaintiff's knowledge of it at the date of contract" (*Mathews v. Baxter*, L.R., 8 Ex. 132). Pollock's "Contracts," 8th edit., p. 93.

### Drunkenness and "Serious and Wilful Misconduct" under the Workmen's Compensation Act.

It has been decided, in several cases in the Scottish Appellate and the English County Courts, that for a workman to be performing his duties in a drunken condition may amount to serious and wilful misconduct. Under the Workmen's Compensation Act, if an accident is due to the workman's "serious and wilful misconduct," the master will not be liable unless the injury results in "death or serious and permanent disablement" (W.C.A., Section 1, 2 [6]).

*Drunkenness—Serious and Wilful Misconduct* (W.C.A., Scottish).—The applicant was proved to have been drunk, and to have caused the accident by his being in that condition.

THE LORD PRESIDENT: "It has been found . . . that the appellant came to his work the worse for drink, and that the accident happened solely from his being drunk and unfit for work."

Held: "Serious and wilful misconduct."

[*M'Groaty v. John Brown and Co.*, 1906, 8 F., 809.]

*Drunkenness* (W.C.A., County Court).—The applicant mounted a ladder out of bravado while drunk, carrying a long piece of timber on one shoulder. It was proved that no wood was required for the scaffolding, and that the way in which he went up the ladder by clutching at each rung, instead of gripping the sides, was improper, and the Judge held "the whole proceeding was a piece of bravado."

Held: "Serious and wilful misconduct."

[*Burrell v. Avis*, Greenwich C.C., Judge Addison; 1898, 106 L.T.J., 61; 1 W.C.C., 129.]

*Drunkenness—Serious and Wilful Misconduct* (W.C.A., County Court).—The workman arrived at his work drunk, and the Judge held:

"I am . . . satisfied of the serious and wilful misconduct of the workman—namely, coming drunk and being drunk on the works, and that the accident was due to this."

[*Bradley v. The Salt Union, Ltd.*, Runcorn C.C., Dep. Judge Strahan; 1907, 132 L.T.J., 302; 9 W.C.C., 31.]

*Drunkenness—Serious and Wilful Misconduct* (Scottish Sheriff's Court).—The workman started work at ten o'clock, when he had the appearance of having been drinking, although not then unfit for work. At eleven o'clock he went out and got some whisky, which he drank. He was then seen, when dipping his brush into the pail which was beside him on a plank on which he was standing, to lurch forward and fall to the ground, by which he sprained his ankle. The arbitrator found that the accident was caused by the workman falling off the plank when under the influence of liquor, and that this injury was due to serious and wilful misconduct.

[*Livingstone v. Murchie and Co.*; *The Policy Holder*, 1908, vol. xxvi., p. 67.]

### Death.

When a drunken man has been found dead, the master may, however, be able to avail himself of the defence that it has not been shown that the injury "arose out of and in the course of the employment."

An accident must be proved to have been "arising out of and in the course of the employment" before compensation can be claimed under the Workmen's Compensation Act. The onus of proof is on the dependants, and they may not succeed in discharging it in the case of a workman found dead, and who was drunk when last seen alive.

*Drunkenness; Death* (W.C.A., Scottish).—A workman was proved to have returned to his ship drunk, and to have been found dead in a place on the ship where he had no right to go.

Held: "The dependants have not proved that the accident arose out of and in the course of the employment, and the onus was upon them to prove that it did so arise."

[*O'Brien v. The Star Line, Ltd.*, 1908, 45 S.L.R., 935; 1908, S.C., 1258; 1 B.W.C.C., 177.]

See below, Case Guide: Death.

## AMPUTATIONS.

In the medical parts of this work there is no separate section upon the effect of amputations ; but legally they are important with regard to capacity to work and damages recoverable or the sum payable in redemption under the Workmen's Compensation Act.

The law relating to Operations and Treatment is discussed on p. 24.

**Serious and Permanent Disablement.**—Loss of two fingertips was held to be such disablement.

[*Hopwood v. Olive and Co.*, 1910, 3 B.W.C.C., 359.]

*Contra*: *Loss of one Finger.*—See *Husband v. Campbell*, 1903, 5 F., 1146.

## Capacity for Work affected.

## Shoulder, Arm, and Hand :

*Engine-Cleaner—Right Arm above Elbow* (W.C.A., Scottish).—An offer of work was made by master instead of compensation. Refusal on ground that there was no guarantee of permanency . . . and that the man was satisfied that he was not equal to the work with one arm. "If anything more suitable turns up hereafter it would be given him." The arbitrator found as facts: That while he could clean part, he could not do the whole work of an engine-cleaner ; that he would not be entitled to, and could not get, full wages as engine-cleaner ; that in the ordinary course he would be eligible for promotion to be engine-driver, and that now he was not eligible ; and that in consequence of his injury his wage-earning capacity was diminished.

LORD PRESIDENT : "There is nothing in the statute which would require that a workman who has lost his right arm shall remain in the service and endeavour to clean engines with his left hand. It is common knowledge that when a man has sustained a serious injury in connection with dangerous mechanism, he is apt to be scared and timorous about having anything to do with that mechanism again ; and I think this should not be left out of view when it is said that the respondent's refusal of the terms offered by the appellants is capricious. The offer is not made in perpetuity, or for any definite period, and even if it had been the respondent would not have been bound to accept it in lieu of compensation provided by the Act."

Held: "That the refusal of the workman to accept the offer of employment did not exclude his right to compensation if otherwise well founded." (The award of six shillings weekly as partial incapacity was sustained by Court of Session.)

[*Fraser v. Great North of Scotland Railway*, 1901, 5 F., 908.]

**Arm.**—See below, *Malingering*, *Bevins v. Pellett and Co.*, p. 999.

## Hand and Fingers :

Judging by the recorded cases, the commonest amputation is that of one or more fingers, and upon this some work has been done in calculating the percentage of the working capacity which

a man loses by the amputation of a finger. In the February number of the *Practitioner*, 1909, Dr. John Alexander Mackenzie puts these percentages of loss in a table, which he has kindly given us permission to reproduce here. The calculations are of course based on unskilled labour.

### The Remainder of the Hand being Intact.

RIGHT HAND.					
Thumb	-	-	25%	}	
Index	-	-	20%	}	40%
Middle	-	-	16%	}	35%
Ring	-	-	10%	}	30%
Little finger	-	-	14%	}	25%
				}	55%
				}	45%
				}	50%
				}	75%

LEFT HAND.					
Thumb	-	-	20%	}	
Index	-	-	15%	}	30%
Middle	-	-	10%	}	25%
Ring	-	-	5%	}	25%
Little finger	-	-	10%	}	20%
				}	40%
				}	35%
				}	45%
				}	55%

### The Remainder of the Hand being Impaired.

RIGHT HAND.					
Thumb	-	-	35%	}	
Index	-	-	25%	}	50%
Middle	-	-	25%	}	40%
Ring	-	-	25%	}	45%
Little finger	-	-	20%	}	40%
				}	70%
				}	55%
				}	60%
				}	65%
				}	80%

LEFT HAND.					
Thumb	-	-	30%	}	
Index	-	-	20%	}	40%
Middle	-	-	20%	}	30%
Ring	-	-	20%	}	40%
Little finger	-	-	15%	}	30%
				}	55%
				}	45%
				}	50%
				}	55%
				}	60%

*Ship's Carpenter : Thumb* (W.C.A., County Court).—Loss of the top of the left thumb produced permanent incapacity for his work. [Miller v. The Cuban Steamship Company, 1909, Judge Lumley Smith, City of London Court; *Post Magazine*, vol. lxx., p. 6.]

*Carpenter—Circular Saw : Finger* (W.C.A., County Court).—“Having lost one of his fingers, and two other fingers being injured, the man was incapacitated from his work at the circular saw.”

[*Ellis v. Knott*, 1900, Judge Smyly, Derby County Court; *Times*, April 9, 11 W.C.C., 116.]

*Carter : First and Middle Left Fingers* (W.C.A., Scottish).—Left hand crushed so that the first and middle fingers had to be amputated.

Held: “Totally incapacitated for his work as a carter.”

[*Colville v. Anderson and Gibb*, 1902, 5 F., 255.]

*Porter of Coal at Gas Works : Four Fingers of Left Hand* (W.C.A.).—In December, 1899, one Clark lost part of the four fingers of his left hand. He was held to be permanently incapacitated for work as a coal-porter, and was paid compensation and offered employment as gate-keeper by his masters, which, though apparently it was suitable, he refused, but eventually he accepted it. He appears to have refused to do this work in a proper manner, and was dismissed. He then made *bona-fide* efforts to find such work as he was capable of doing, and failed.

COLLINS, M.R.: “The standard of compensation is the difference between the wages he was able to earn before the accident and the wages he is able to earn after the accident. If the applicant, after repeated attempts, could not find an opportunity of putting his diminished powers of work into operation, he was justified in saying that his wage-earning capacity was not the same as before.”

[*Clark v. The Gas Light and Coke Company*, 1905, 21 T.L.R., 184; 7 W.C.C., 119.]

*Collier—Misconduct : Three Fingers Amputated, the Fourth Stiff* (W.C.A.).—At Pontypridd it appeared that the workman, a collier, was injured by accident within the meaning of the Act in November, 1907, resulting in permanent injury to his left hand. Three fingers were amputated, and the fourth injured so that the motion of the joint was lost. He received full compensation from his employers until the end of May, 1908, when he was made a master haulier. His wages as a collier had averaged £2 7s. 7d. per week. His wages as a master haulier averaged £2 9s. 6d. As master haulier, he failed to attend at his work for three days in the fortnight ending July 18, 1908, for four days in the fortnight ending August 15, 1908, and for four days in the fortnight ending December 15, 1908. After the last absence from his work, he was dismissed by the employers.

The County Court Judge found that the workman's absences from his work as master haulier were due to his drinking habits, and not, as he stated, owing to his hand or his being ill, and that his inability to earn his former wages were due to passion for drink, and not to the accident. He held that the facts in this case were distinguishable from those in *Clarke v. The Gas Light and Coke Company* (see above), and he made his award in favour of the employers.

COZENS-HARDY, M.R.: “This appeal raises a great question which from one point of view is an important one. [The learned Judge then related the facts set out, *supra*.] Now, it would, in my judgment, be shocking if we were to hold that, when a man employed

at an adequate wage vacates his position by reason of his own misconduct, he was entitled at once to obtain compensation from the employers. For the fact is that his incapacity is due to his own misconduct. But it is quite another proposition to say that by one act of misconduct a workman loses for ever his right of claiming compensation from his employers. This man was partially incapacitated by reason of the accident, and therefore he would be entitled to some weekly payment. . . . Mr. Russell, on behalf of the employers, has now offered to do that which was not suggested on behalf of the workman in the County Court, to submit to a suspensory award for id. a week. And our order will be that such an award be made. But the appellant must pay the costs."

[*Hill v. Ocean Coal Company, Ltd.*; 3 B.W.C.C., 29.]

### Leg and Foot:

*Tram-Driver: Leg below the Knee* (W.C.A., Scottish).—Loss of leg below the knee.

Held: "Permanent disablement for his then employment of cable tram driver."

[*Mooney v. Edinburgh and District Tramway*, 1901, 3 F., 390.]

*Carter: Left Leg* (W.C.A., Scottish).—Through an accident the man lost the left leg.

Held: "Now unfit for his work as a carter."

[*Bathgate v. The Caledonian Railway Company*, 1901, 3 F., 313.]

### Capacity for Work unaffected.

*Third Finger* (W.C.A., Scottish).—Capacity not lost. Award terminated. A lad of seventeen lost the third finger of his left hand, and was proved to be capable of earning as much after his accident as before at his old work, but claimed he was entitled to a nominal award. "The applicant admits (as does also the medical man examined on his behalf) that he could now do his old work although deprived of one finger, and I find, in fact, he could have done it."

LORD TRAYNER: "The rule which the statute lays down is that where the incapacity has ceased the compensation shall cease. That is the rule of the statute, but the courts, both here and in England, have recognized an equitable exception in cases where the claimant has apparently recovered, but his injuries are of a character in which serious consequences may after develop themselves. In cases of that kind the court may keep the matter open by authorizing a nominal award of compensation. . . . But it appears to me that the present case does not fall within the exception."

[*Husband v. Campbell*, 1903, 5 F., 1146.]

### Capacity for Work unaffected at Present—Future Incapacity considered.

*Thumb and Three Fingers of the Right Hand* (W.C.A., Scottish).—No present loss of capacity. A boy earning five shillings weekly wages doing nondescript work had reached an age and experience when he would be promoted to the duties of a "packer" at eight shillings weekly, when he lost the thumb and three fingers of his

right hand. The question was whether the future wage-earning capacity could be taken into account.

Under Schedule 1, Section 16, W.C.A., 1906, on an application to review, this can be taken into account for minors.

Held: "The test of a workman's right to compensation was the diminution of his earning capacity in the future by reason of the injury received, and that the mere fact that at the date of his claim he earned the same wages afterwards as he did before the accident did not necessarily exclude the claim under the Act." Held further: "If the workman has not, when he makes his claim, suffered any loss, the proper course is . . . to make a declaration of liability . . . leaving the amount of duration to be fixed upon an application . . . to vary the award . . . should the workman at any future time be unable, by reason of the accident, to earn the same wages."

[*Freeland v. Macfarlane*, 1900, 2 F., 832.]

### Damages and Amount paid in Redemption of Weekly Payments.

#### Shoulder, Arm, and Hand :

*Fingers—Negligence.*—Three fingers cut off the left hand of an infant apprentice; 5s. a week wages. Damages agreed on, £275.

[*Stephens v. Dudbridge Iron Works*, 40 S.L.R., 81.]

*Second, Third, and Fourth Fingers, Right* (W.C.A., redemption for lump sum).—A workman, aged twenty-eight, engaged as a book-binder, lost the second, third, and fourth fingers of the right hand. After the accident he received compensation at the rate of 13s. 5d. for six months. He then agreed to accept the sum of £255 in full settlement. He was quite satisfied with the amount, but His Honour Judge Emden refused to register the agreement, holding that the sum was not adequate, and pointing out that it did not nearly represent the value of a Post-Office annuity to produce 75 per cent. of 13s. 5d. (see Workmen's Compensation Act, 1906, Schedule 1 [17]). It was proved that the applicant could write, and was a highly intelligent man anxious to start in business, but that he had lost the power of grip in his right hand.

[*Freeman v. Watkins and Co*, Lambeth C.C., Judge Emden. Local papers, September 30, 1909.]

*Printers' Cutter : Third and Fourth Fingers, Right Hand* (W.C.A., redemption).—The applicant agreed to accept £65 in full settlement of his claim. The Judge said that he did not think it was enough, and thought that £100 at least ought to have been paid.

[*Letts v. Kehiler and Co.*, City of London Court, Judge Lumley Smith. *Post Magazine*, 1909, vol. 70, p. 371.]

*First Finger, Right* (E.L.A.).—The first finger of the right hand of a young mechanical engineer, who was earning about 30s. weekly, was amputated by machinery. Damages, including special damage, £63 15s. 6d.

[*Heath v. Gamage*, Clerkenwell C.C., Judge Bray, and jury. Local papers, October 23, 1908.]

*First Finger, Left, Part of—Negligence.*—Part of the first finger of the left hand of the plaintiff, a girl of seventeen, was cut off. Her wages were about 6s. weekly. Damages £15 12s.

[Ashton v. Pullivant, Clerkenwell C.C., Judge Edge, and a jury. Local papers, November 30, 1908.]

*Three Fingers—Negligence.*—The plaintiff, a child, was told by another child to put his fingers into some machinery exposed for view in the market-place. The result was the loss of three fingers. Damages assessed at £10.

[Mangan v. Atherton, Lichfield C.C., on appeal in 1866, L.J.Ex., 161.]

*Fingers crushed, Child—Negligence.*—A railway porter negligently closed the door of a railway carriage and crushed the fingers of the plaintiff. Damages £5.

[Coleman v. South-Eastern Railway Company, on appeal in 1866, 4 H. and C., 699.]

### Leg and Foot:

*Leg and Fractured Collar-Bone—Negligence.*—Plaintiff was thrown down by a motor-omnibus, and in consequence had her collar-bone broken, and had to have leg amputated at knee. Damages £750.

[Charles v. Broderick Company.]

*Leg—Negligence.*—An infant trespassed through a defective fence and was injured. His leg had to be amputated. Damages £550.

[Cooke v. Midland Great Western Railway of Ireland, 1909, 25 T.L.R., 375.]

*Leg—Negligence.*—The plaintiff was knocked down by a train, and his leg had to be amputated. At the first trial the jury awarded damages. Damages £350.

[Ellis v. Great Western Railway Company, 43 L.J., C.P., 304.]

*Leg crushed—Negligence.*—A gate being left open by the railway company opposite a level-crossing, the plaintiff in going over the line was knocked down and his leg crushed. At the first trial, damages £250.

[Cliff v. Midland Railway, 22 L.T., 382.]

*Leg, Right (W.C.A., redemption for lump sum).*—An infant aged fifteen lost his leg at the thigh, and his parents agreed to accept the sum of £275 in full settlement and redemption of the employer's liability to pay 8s. 6d. per week. The registrar referred the case to the Judge, who held that the sum was reasonable.

[Gray v. Worth, Holbeach C.C., Judge Mulligan. Local papers, May 10, 1909.]

*Great Toe.*—The plaintiff, a carpenter, had his big toe cut off by an omnibus. Damages £100.

[Kingsman v. London Road Car Company, Mayor's Court, Sir Forrest Fulton and a jury.]



### Operation.

*Index-Finger fractured* (County Court).—Operation. (See above, Medico-Legal Aspect of Accident—Operation, p. 24.) The finger was stiff and useless. On the medical evidence on January 30, in favour of an operation, the Judge adjourned the case for four months on the undertaking that the man would forthwith have his finger amputated, the employers to pay the expense of the operation and give the man compensation meanwhile.

[*Gray v. United Alkali Company*, 1909. *Policy Holder*, xxvii., 133.]

*Amputation Operation* (W.C.A., Scottish).—Amputation of second finger and removal of a nodule in the palm “were simple or minor operations,” which it was unreasonable for the man to refuse to undergo.

[*Donnelly v. Baird and Co.*, 45 S.L.R., 394; 1 B.W.C.C., 95.]

## ANÆSTHESIA.

The duties and rights connected with Operation are fully discussed above in Medico-Legal Aspect of Accident—Operation (p. 24 *et seq.*).

Dr. Blumfeld’s article on Anæsthetics points out that, roughly speaking, there are three chief kinds of anæsthesia in use by surgeons. There are legal points connected with each of these three kinds.

### General Anæsthesia.

This includes administration of chloroform, ether, or gas, or other anæsthetic rendering the patient completely unconscious and insensitive to pain over the whole body.

*Danger—Kidney Disease* (W.C.A.).—A workman claimed that an accident had caused double rupture, and his own doctor recommended him not to submit to an operation requiring general anæsthesia, as he considered it unsafe with the kidney disease from which he was also suffering.

[*Tutton v. The s.s. Majestic*, 1909, 2 K.B., 54; 2 B.W.C.C., 346.]

*Death—Operation to cure Effects of Accident* (W.C.A.).—Where a workman underwent anæsthesia to cure a defect caused by the injury, and died under it, the master was held liable, as the operation was reasonably undergone, to correct the consequences of the injury.

[*Shirt v. The Calico Makers’ Association*, 1909, 2 K.B., 51; 2 B.W.C.C., 342.]

*Death—Operation not connected with Effects of Accident* (W.C.A.).—An injured man submitted to anæsthesia to undergo an operation to correct a condition caused by an accident. He recovered from the anæsthetic, and then it was remembered by the surgeon that he had requested that a tooth, which had caused him pain, should be removed. A fresh administration of an anæsthetic was given, and he died under this.

The second operation being to cure a defect in no way connected with the injury, the employer is not liable for the death under the anæsthetic.

Held: "Not due to the original accident, and the master is not liable for the consequences of death."

This award was upheld by the Court of Appeal.

[*Charles v. Walker*, 1909, 2 K.B.; 2 B.W.C.C., 5.]

### Spinal Anæsthesia.

This is produced by the injection of drugs into the spinal canal whereby the body below the injection is rendered insensitive to pain, but the general consciousness is not impaired. (This form of anæsthesia at present is regarded as in its experimental stage in England, and is by no means free from dangers.)

This was suggested as an alternative by the medical men for the employers in *Tutton v. The s.s. Majestic (ubi sup.)*. The workman's medical advisers recommended him not to submit to it.

### Local Anæsthesia.

Here drugs are injected under the skin or applied to the surface, which by this means is rendered locally insensitive to pain, but not always to touch. The consciousness of the patient is not lost.

This is much used, and commonly without any dire results, or objection from the injured man.

*Anæsthesia in Operation for Glass-Blower's Cataract.*—The usual operation for cataract is one which requires local anæsthesia, though occasionally general anæsthesia is used for timid persons.

The glass-blower's cataract, which is mentioned in the recent addition to Schedule 3 of the Workmen's Compensation Act, is removed by operation under such circumstances.

### Dread of Anæsthesia.

Among the reasons for dread of operation, the commonest is that of anæsthesia, so the cases are given here as "dread of anæsthesia."

Fear of operation has been discussed under several conditions, and in some cases this has been held reasonable, in others not.

In *Donnelly v. Baird*, Lord Justice M'Laren, in discussing operation, said: "If in such a case the sufferer, either from defect of moral courage . . . refuses to be operated on, I should have no difficulty in holding that his continued inability to work . . . was the result of his refusal of remedial treatment."

[*Donnelly v. Baird*, 1903, S.C., 536; 45 S.L.R., 394; 1 B.W.C.C., 97.]

The Master of the Rolls in another case said: "The operation is one which any man of ordinary nerve would submit to in his own interest."

[*Warncken v. Richard Moreland*, 1909, 1 K.B., 184; 2 B.W.C.C., 350.]

Judge Rentoul, in the City of London Court, held: "That as the medical evidence was in favour of the workman's undergoing opera-

tion, 'as a reasonable man he ought to submit to it,' though the evidence showed that the workman 'dreaded operation, and feared that he might not recover or might be impaired in health, because with a previous operation he had been a long time getting over it.'

[Gilbert and Co. *v.* Fairweather, 1 B.W.C.C., 349.]

For a case where natural timidity analogous to this fear was the reason for a refusal to be operated upon, a refusal which was supported by the Court of Appeal, see *Smith v. Coed Taton Colliery*, which is discussed under *Bones—Arm*.

As has been said, the whole question of Operation and Treatment is discussed above, p. 24 *et seq.*

### ANKYLOSTOMIASIS.

This miner's disease is scheduled in the third schedule of the Workmen's Compensation Act, 1906. It is exceedingly rare in England. (See Departmental Committee's Report on Industrial Diseases, 1907, Questions 4,971 to 4,974.)

### ANTHRAX.

This was held to be "a personal injury by accident" within the meaning of the Workmen's Compensation Act, 1897; but it is now included in the third schedule of the Workmen's Compensation Act, 1906, as an industrial disease. The procedure in the case of a workman will therefore be found in the eighth section of that Act, and the question whether its onset could be "an accident" could occur independently of the Workmen's Compensation Act.

The judgment in *Brintons v. Turvey* remains the classic case of an infectious disease being a "personal injury by accident." And when claims are made, in the future, by workmen or others who allege that the "catching" of an infectious disease is a personal injury by accident, the judgment in this case will be available in support of the contention. This matter is further discussed below under *Infection*.

The two anthrax cases were both held to be within the 1897 Act, but only one went to the House of Lords.

In the first case, *Higgins v. Campbell and Harrison, Ltd.*, a workman in a wool-sorting factory caught anthrax, which was held to be an accident under the following circumstances:

He had a pimple upon his neck, which he said was rubbed sore by his collar. In this sore spot anthrax occurred, and the ulcer was excised so that the man recovered. In this case the Court of Appeal held there was an accident.

[*Higgins v. Campbell and Harrison, Ltd.*, 1904, 1 K.B., 328; 6 W.C.C., 1.]

In the second case, *Brintons v. Turvey*, the injured man died, and the case went to the House of Lords, where the following judgments were given:

THE LORD CHANCELLOR: "A personal injury by accident, in popular phraseology, from which we are to seek guidance . . . excludes, and was intended to exclude, idiopathic disease; but, then, if

some part of our physical frame is in any way injured by an accident, we must be on our guard that we are not misled by medical phrases to alter the proper application of the phrase "accident causing injury," because the injury inflicted by accident sets up a condition of things which medical men describe as a disease. Supposing in this a tack or some poisoned substance had cut the skin and set up tetanus. Tetanus is a disease, but would anybody contend that it was not an accident causing danger? An injury to the head has been known to set up septic pneumonia; and many years ago, I remember, when that accident had in fact occurred, that it was thought to excuse the person who inflicted the blow on the head from the consequences of his crime because his victim had died of pneumonia, and not, as was contended, from the blow on the head."

LORD MACNAGHTEN: "It was an accident that the noxious thing that settled on the man's face happened to be present in the material which he was engaged in testing. It was an accident that this noxious thing escaped the down-draught or suck of the fan. . . . It was an accident that the thing struck the man on a delicate and tender spot in the corner of his eye. It must have been through the same accident that the poison found entrance into the man's system, for the Judge finds that there was no abrasion about the eye, while the medical evidence seems to be that without some abrasion infection is hardly possible. The accidental character of the injury is not, I think, removed or displaced by the fact that, like many accidental injuries, it set up a well-known disease, which was immediately the cause of death."

LORD LINDLEY: "I hope that the decision in this case will not be regarded as involving the doctrine that all diseases caught by the workman in the course of his employment are to be regarded as accidents within the meaning of the Act. The fact that an accident caused injury in the shape of disease does not render the cause not an accident."

LORD ROBERTSON, in a dissentient judgment, ably pointed out that, if the conclusion above were correct, "any other case of disease falling within the wide scope of bacteriology might with equal accuracy be traced to the occurrence of a similar accident." And, "I must add that the illustrations given by one of my noble friends, of tetanus, pneumonia, or erysipelas, ensuing on accidents differ from the present case in the one point essential to the controversy; for in the illustration there is postulated an accident distinct from the disease, while in the case before your lordships the 'accident' so called was simply the inception of the disease."

[*Brittons v. Turvey*, 7 W.C.C., 1; 1905, A.C., 230.]

*Anthrax in a Wool-sorter* (W.C.A.).—A wool-sorter caught anthrax and died. His dependents received full compensation.

[*Osmond v. Campbell and Harrison*, 1905, 22 T.L.R. 4; 8 W.C.C., 95.]

## APPENDIX.

Appendicitis is not a new pathological condition, or a new disease, but an old disease the exact nature of which has recently been

discovered. Formerly it was known as perityphlitis, colitis, intestinal obstruction, or even peritonitis.

We have not been able to find a case of injury to the healthy appendix causing "appendicitis." This is what would be expected from reading Mr. Sherren's article.

**Appendix (Diseased)—Insurance.**—Words of the policy: "Death solely from bodily injuries effected . . . through external, violent, and accidental means."

An operation was performed upon the insured.

"It was discovered that there were hard substances in the appendix about the size of a bean, called 'coprolites' or 'concretions,' which would take months to form."

It was proved that—

"The psoas muscle, the function of which is to fix the thigh upon the body and rotate the leg and thigh upward, lies in close proximity to the appendix, and in such position that when brought into play, as by riding a bicycle, it necessarily rubs against the appendix, and there being . . . a concretion . . . in such organ, such rubbing . . . caused irritation, resulting in inflammation, which, weakening the walls of the appendix, caused it to rupture, . . . causing appendicitis (*sic*), septic peritonitis, and death."

"We can conceive of nothing upon which it can be said . . . that his death . . . resulted from bodily injuries effected . . . through external, violent, and accidental means 'within the meaning of the policy. . . .' He sustained no fall or shock; came into collision with nothing; he went where he chose; selected his route, . . . and brought into play such muscles of the body, and only such, as he willed. The result of the ride, though extraordinary, in no way proved that it was accidental. The most that can be said in such cases . . . is that the result was accidental, but the means which provided it were not accidental."

*Appel v. Ætna Life Assurance Corporation*, 86 App. Div. Reps. C. N. York, 83.

[Quoted by Bray, J., in *Scarr v. General Accident Association*, 1905, 1 K.B., at p. 395.]

**Appendix (Diseased)—Rupture of Abscess** (W.C.A., County Court).—A dustman was employed by the Westminster City Council, and on April 15 knocked a heavy bin, full of dust, against the ceiling of the passage along which he was carrying it. He worked with pain and difficulty till the 18th, when he gave up. He then went home to bed, and saw his own doctor; but in a day or two, getting much worse, he was sent into the infirmary, where he was operated on. He died on April 23 of the same year, 1909.

The post-mortem disclosed acute general peritonitis, with a large quantity of matter (pus) in the abdomen. There was also round the appendix a mass of old adhesions, due to former attacks of appendicitis. These adhesions were round an abscess enclosing a recently ruptured appendix.

The arbitrator held that the knocking of the dustbin was an accident, and that the deceased died in consequence of acute general

peritonitis starting from rupture of an old abscess round the diseased appendix.

[*Brownhill v. Westminster City Council*, Westminster C.C., Dep. Judge, Lush-Wilson. Local papers, November 12, 1909.]

### BEAT HAND, BEAT KNEE.

The judgments in these cases are of importance in determining what is "a personal injury by" accident as opposed to a "disease"; for though they are now scheduled industrial diseases under the Workmen's Compensation Act, 1906, the decisions under the 1897 Act were to the effect that, as they were diseases of gradual onset, they were not "personal injury by accident."

The names include at least two pathological conditions—viz., bursitis, or inflammation of the bursæ; and cellulitis, or inflammation of the loose tissues of the parts affected.

COLLINS, M.R.: "In each case the injury was caused by the gradual process of continued friction. The accident must be something which is capable of being assigned to a particular date, and which is in the popular and ordinary sense an accident. These conditions are not fulfilled in the present case."

[*Marshall v. East Holywell Coal Company*, and *Gorley v. Backworth Collieries*, 1905, 21 T.L.R., 494; 7 W.C.C., 19.]

### BLADDER.

Accidental injuries to the bladder are usually associated with other wounds of the pelvis, so that cases in which the bladder alone is injured rarely come before the Courts; and even when they do, the popular papers naturally avoid mentioning the part injured.

The two conditions of stone in the bladder and enlarged prostate, both common in advancing years, have given rise to unfounded claims of injury. The prostate gland enlarges in old age from the normal size (about that of a walnut) to a tumour which may even reach the size of a closed fist. This enlargement may be painless at first, but later pains appear in the loins, thighs, and abdomen. As the pains are gradual in their onset and tolerance of pain is often acquired, no notice may be taken of them till a slip or blow directs attention to the parts.

*Enlarged Prostate—Claim for Dislocation of the Pelvis* (W.C.A., County Court).—The workman claimed that two years ago he slipped his foot in a hole on board ship and hurt his back. He walked part of the way to the hospital and part of the way home, where he was treated as suffering from a slight accident. He stopped in bed ten days, and returned in two months to full work of stevedore.

He now claimed that he had had dislocation forwards of the right sacro-iliac joint, a condition which the respondent's doctor said was incompatible with ability to walk. At the arbitration he complained of loin and abdominal pains. The employers proved

that the whole of this pain was due to an enlarged prostate gland, and that there was absolutely no displacement of the sacrum.

[Smith *v.* The Canadian Pacific Railway Company, Bow C.C., Judge Smyly. Local papers, June, 1908.]

## BONES.

Accidents to bones may produce two distinct consequences, which are here separated. The commonest result of an accident to a bone is a fracture, which when cured usually leaves no further symptoms. The other consequence which follows an accident is disease, either arising *de novo*, or which, having been present before, is stirred into activity and rendered worse by the accident. The contrast between a mere fracture and disease is of great importance medico-legally, as, while simple fractures usually heal completely, disease may be permanent in its effects, and is sometimes progressive. In the following cases we have noted two points about each fracture: the amount of damages or lump sum paid in redemption of weekly payments under the W.C.A. awarded by the Court, and the duration of the incapacity which plaintiff has claimed to have followed the injury—a duration which is often grossly exaggerated. A short note on Treatment and Operations in connection with injuries to bones, where that subject has been before the Court, is separately given at the end of this section.

The cases are classified according to the part injured, as follows: Head; Shoulder, Arm, and Hand; Ribs; Pelvis, Leg, and Foot.

### Damages and Lump Sums in Redemption of Compensation for Fractures.

**Head—Skull—Negligence.**—A child had her skull fractured and scalped, her knee cut, and her leg wounded. The pupil of her right eye was permanently displaced, and the nerves of the eye injured, causing neuralgic pain and paralysis of the muscles of the eye. She suffered from sleeplessness and screaming at night, and had permanent scars on her head and face. Damages £175.

[Floyd *v.* Gibson, on appeal; C.A., 1909, *Times*, March 27.]

**Jaw.**—Phyllis Reed, aged four years, was knocked down by the horse of the defendants; she suffered from a fractured jaw and concussion. The damages were agreed at £20.

[Reed *v.* Kavanagh, Kingston C.C. Local papers, February 15, 1908.]

**Nose broken—Negligence.**—The plaintiff broke her nose against a plank, which by its situation was of the nature of a trap, as it could not be easily seen. Damages £40.

[Watkins and Wife *v.* Great Western Railway Company: Worcester Assizes, Grove, J., and special jury. Appeal reported in 1877, 46, L J., C.P., 817.]

**Shoulder, Arm, and Hand—Humerus: Arm above the Elbow—Negligence.**—A jockey, whose arm was broken by a flap in a horse

box falling upon him, was well and able to ride in races three months after the accident. Accident December 30, 1907, and rode in race on April 2, 1908 (three months). The doctor said he would be quite well in two months. Damages £200.

[Duller *v.* The London and South-Western Railway Company, King's Bench, Coleridge, J., and common jury; 1908, *Times*, November 3 and 4.]

*Left Arm—Negligence.*—The plaintiff, a lad at the school of the Surrey County Council, caught his foot in a hole in the asphalt paving of the playground, and fell, breaking his left arm. His father, as next friend, sued for damages for the injury caused by the negligence of the Surrey County Council, and he was awarded £83 19s. 6d.

[Ching *v.* Surrey County Council, Guildford Assizes, March 5, 1909, Bucknill, J., and common jury; 1909, 2 K.B., 762.]

*Ribs—Ribs—Negligence* (E.L.A., County Court).—A workman earning 39s. 6d. weekly suffered from an injury of which he claimed: "I have fractured my ribs and broken one, also bruised myself internally." Date of the accident November 22, 1899; duration of incapacity, twelve weeks. Damages £15.

[Treanar *v.* Wells and Co., 1900, Marylebone C.C., Judge Stonor and jury; L.T., 302; 3 W.C.C., 58.]

*Rib—Contract.*—Fracture of a rib by falling out of railway-carriage door. Damages agreed at £85, including special damages.

[Anthony *v.* The Midland Railway, Birmingham County Court, Judge and jury. Appeal reported in 1908, *Times*, November 25.]

*Pelvis, Leg, and Foot—Pelvis: Partial Fracture—Negligence.*—The plaintiff was thrown from a stage-coach and injured. Sir Victor Horsley found "the plaintiff was suffering from pain in the abductor and pubic nerves, that there was very severe injury to the surface of the pubic bone, and he considered the bone was somewhat displaced. He would gradually get better; it was quite possible the bone was not broken right across." Damages £400.

[Kilner *v.* The London United Tramways, King's Bench, Phillimore, J., and special jury; 1909, *Times*, February 2.]

*Femur: Lower End—Negligence* (E.L.A.).—Broken on November 12, 1907. Duration of incapacity not stated. Awarded £126.

[Herbert *v.* Turpen and Co., Bloomsbury C.C., Judge Bacon. Local papers, March, 1908.]

*Kneecap.*—The plaintiff, who was a plumber by trade, had his kneecap broken by the sudden starting of a tramcar. Damages £100.

[Cooke *v.* London County Council Tramways, Westminster C.C. Local papers, March 3, 1908.]

*Tibia, Left—Negligence.*—In February, 1908, Alice Wing, a married woman, an artificial-flower maker, earning an average of 12s. a week, was injured by the negligent driving of the London General Omnibus Company, and broke a bone in her foot. The bone united, but not quite straight. She was incapacitated for at least five months. Damages £34.

[Wing *v.* London General Omnibus Company, Clerkenwell C.C., Deputy Judge and jury. Local papers, May 22, 1908.]



*Leg—Negligence.*—A milkman slipped on faulty pavement and broke his leg. He was incapacitated for sixteen weeks. Wages £1 a week. Damages £18.

[Harlow *v.* Mahony, Greenwich C.C., Judge Willis. Local papers, February 24, 1908.]

*Tibia and Fibula—Negligence.*—A man aged over ninety was knocked over on May 23, and had to be medically attended till September 23 (four months). Both bones of his right leg were broken, and there had been great difficulty in getting the fracture to unite. The union was 20 to 30 degrees out of place. Damages £10 10s.

[Clapham *v.* Barret, Clerkenwell C.C., Judge Edge. Local papers, November 2, 1908.]

*Fibula—Negligence.*—Damages £25. See below, Incapacity, Catermole *v.* Watkins.

*Leg broken—Negligence.*—The plaintiff's leg was broken by the fall of an anchor caused by the collision of two ships. Defence, contributory negligence. Damages £200.

[Greenland *v.* Chaplin, Court of Exchequer, 19 L.J.Ex., 293.]

*Leg broken—Negligence.*—The plaintiff unsuccessfully sued for the damages for her broken leg. Damages agreed at £25.

[Lygo *v.* Newbold, Court of Exchequer, 23 L.J.Ex., 108, and 9 Ex., 302.]

*Ankle—Negligence.*—The plaintiff, a builder, stumbled over a defect in the pavement. His ankle was badly fractured, and he was detained in the hospital for three weeks. Damages assessed at £100.

[Nelson *v.* Langlois, Mayor's Court, Sir Forrest Fulton and jury. Local papers, May 9, 1908.]

*Ankle Fracture—Evidence not accepted (W.C.A.).*—The workman was employed in some building and repairs; the ladder on which he was standing was blown over, and he fell to the ground and was injured. He continued to work for the rest of the day. On the next day he did some work, but later said he did not feel well, and went home. Before going home he saw his master, and told him that he had hurt his knee; he then walked off to a job a quarter of a mile away. The employers admitted liability for the injury to the knee, and paid compensation; an agreement was recorded on January 29, 1910. An application was then made by the workman that this agreement should be reviewed, and the question decided as to whether in December he broke his ankle in addition to the injury to the knee, and, if so, whether he was still incapacitated by the ankle. The workman said that he had never had an accident to his ankle except that of September, and that when the accident happened he felt a pain in the right ankle and knee, and got a man to wheel him home on a truck.

The doctor at the infirmary was called, and in cross-examination was shown a radiograph of the man's ankle. He said that the bone showed a fracture at the ankle, but that it would be impossible to tell when the fracture took place. He never heard of a man with such a fracture continuing to work afterwards, and being able to go to work the next day.

His Honour found that the fracture did not arise from the accident in September, and therefore terminated the agreement for compensation. The workman appealed to the Court of Appeal, who dismissed the application with costs.

[Rayman *v.* Fields (No. 2), 1910, 3 B.W.C.C., 122.]

*Foot—Negligence.*—The injury happened on November 21, 1907, while riding a bicycle. The plaintiff recovered enough to ride again to his work in March, 1908. Three months' incapacity. Damages £50.

[Harrison *v.* Freeman, King's Bench, Darling, J., and special jury; 1908, *Times*, November 18.]

*Foot: Tuberculosis.*—See below, Disease.

### Incapacity: Duration, etc.

**Shoulder, Arm, and Hand**—*Shoulder.*—See below, Operation and Treatment.

*Clavicle* (W.C.A.)—A gardener broke his collar-bone, and claimed that he was incapable of working for fifteen weeks.

[Bently *v.* Allport, Brentford C.C., Judge Howland Roberts. Local papers, March 15, 1908.]

*Clavicle: Ununited Fracture.*—See below, Operation and Treatment, p. 889.

*Humerus: "Left Arm broken"* (W.C.A., Scottish).—The accident happened on April 11, 1904. The applicant successfully claimed that her incapacity lasted till the end of September, 1904, and prevented her from following her occupation of "office-cleaner and bag-mender." Five and a half months' incapacity.

[O'Niel *v.* Motherwell, 1907, S.C., 1076.]

*Humerus—Negligence.*—Incapacity two or three months. See above, Damages, Duller *v.* London and South-Western Railway.

*Ulna* (W.C.A., County Court).—In this case, although it was not reported, the injury sustained by the woman was the fracture of her ulna near the wrist. She claimed compensation from the date of the accident to the date of the hearing. Three months' incapacity.

[Hicks *v.* Maxton, Dover C.C., Judge Shortt; 1907, 124 L.T.J., 135; 1 B.W.C.C., 150.]

**Ribs**—*Contract.*—The plaintiff, a baker, was injured on the platform of the "Tube" railway; one rib was fractured, another "partly fractured," and the pleura was torn. He was in bed for four weeks, and able to return to his work in another four weeks. Eight weeks' incapacity.

[Gill *v.* City and South London Railway, Clerkenwell C.C., Judge Bray. Local papers, May 7, 1908.]

*Ribs (Three) and Left Wrist* (W.C.A.)—The applicant fell and broke three ribs and his left wrist. He claimed total incapacity for eight months, and at the date of the hearing said that he was not yet completely recovered—that is, after thirteen months' incapacity.

The Judge accepted his statement that he was totally disabled for eight months, and partially incapacitated for a further five months, but held that he was now, at the date of the arbitration, fit to return to work, and so made an award of one penny a week for the future.

NOTE.—The incapacity probably was here due to the injuries associated with the fractures of the ribs.

[*Blyth v. Sewell*, Norwich C.C., Judge Mulligan ; 126 L.T.J., 552.]

*Ribs* (W.C.A., County Court).—A workman was lifting heavy weights all day, and said that, two hours before he ceased work, he broke the eighth and ninth ribs on the left side by the violence of muscular contraction. He continued at his heavy work for two hours, and made no complaint at the time. The Judge held that the workman had not proved his case.

NOTE.—These ribs are fastened in front to the breast-bone, and behind to the spine, and there is nothing special about the muscles attached to them.

[*Whittle v. Ardley*, City of London Court, Judge Rentoul. Local papers, March 24, 1908.]

*Ribs*.—Incapacity twelve weeks. See above, Damages (*Treanear v. Wells*).

**Pelvis, Leg, and Foot**—*Femur: Extracapsular Fracture of Neck—Concurrent Disease* (W.C.A.).—The applicant was a man of sixty-eight, whose duties were to walk up and down outside a boot shop, selling, dusting, and protecting the stock. His hours were from 8 a.m. to 10 p.m., and he was standing and walking all the time. On June 2, 1908, he was standing on a pair of steps, when he fell and broke the neck of his right thigh-bone (femur); he was taken to the London Hospital, and treated for three months. On January 1, 1909, he began to do two days' work each week, refusing to do more on the ground that he had pain round the hip and could not walk without a stick. This amount of work he continued to do until he came before the arbitrator and medical assessor on March 15, 1910. Evidence was given that he had been examined three times for the employers, and that the doctors in March, 1909, considered him fit for his old work as far as the injured leg was concerned, provided he wore a thick sole to his boot. These doctors confined their examination to the leg. He was finally examined again for the employers, by Mr. Armour, F.R.C.S. (in December, 1909), who reported 1 inch shortening, which he agreed could be remedied by a thick sole. In addition to this undisputed consequence of his injury, he found other maladies—viz.:

1. The nail of each big toe growing right across the next toe, and causing pain.
2. A rupture on each side.
3. Enlarged testicle on one side, and a tumour of the spermatic cord (diagnosed as a sarcoma) on the same side as the injured leg.

The surgeon for the workman admitted that an uncomplicated extracapsular fracture through the neck of the femur should be entirely cured, and the man back at his old work, well within six months.

In this case, however, he thought that there was some complication in the healing, though apparently the medical assessor did not agree with him.

On the evidence and the examination and report of the medical assessor, the arbitrator found that the man's leg had recovered months ago, that the present pain was caused by the other maladies, and that, as far as the accident was concerned, he was fit for his work. The award was reduced to 1d. a week.

[*Burrows v. Newwell*, Bow C.C., Deputy Judge Brooks, and the medical assessor, Frederick Smith, M.D., F.R.C.P.]

*Simple Fracture set badly* (W.C.A.).—Accident November, 1906; total incapacity till December, 1907. Claim in November, 1908, for full compensation. Award made of 10s. weekly. Total incapacity thirteen months; permanent partial incapacity claimed after that.

[*Mason v. Bulley*, Bromley C.C., Judge Emden. Local papers, November 19, 1908.]

*Femur: Fracture, Compound* (W.C.A.).—At the time of the accident the applicant was sixteen years old. There was 1 inch of shortening of the right femur. The lad was found two years after the accident to have a "lateral curvature of the spine and rising of the shoulder." On the whole leg there was a shortening of 2 inches. He was sent back to work with a surgical boot. The Judge apparently held that part of the disability had nothing to do with his incapacity, and that, as regards his injury, he was able to return to the light work offered him, using a surgical boot. He claimed a total incapacity for two years.

[*Cairns v. Tibbles' Vi-Cocoa*, Watford C.C., Judge Howland Roberts. Local papers, April 14, 1905.]

*Tibia*.—Incapacity five months. See above, Damages (*Wing v. London General Omnibus Company*).

*Tibia and Fibula—Negligence*.—The plaintiff, a schoolboy, was knocked over by a barrow, which broke both the bones of his right leg. He was detained in hospital for one month, and afterwards attended as an outdoor patient for another month. (Presumably the hospital authorities regarded him as surgically cured in two months.)

[*Impey v. Masters*, Clerkenwell C.C., Judge Edge. Local papers, March 9, 1908.]

*Tibia and Fibula—Negligence*.—On November 5, 1908, the plaintiff's ankle was run over, "splitting one bone and breaking both." He remained in hospital eleven days, being only able to put his foot on the ground for the first time on Christmas Day. "At the present time he was unable to perform his ordinary business routine." Incapacity three months, and continuous.

[*Nightingale v. S. F. Edge, Ltd.*, Kingston C.C., Judge Amphlett. Local papers, February 15, 1909.]

*Leg* (W.C.A.).—A horse swerved and knocked the workman down, breaking his left leg, on June 3, 1907. By February 24, 1908, "the Judge finds the injuries were so severe that the man has to

use a stick to get about at the present time." Incapacity eight and a half months.

[Spencer v. Harrison, Norwich C.C., Judge Mulligan; 1 B.W.C.C., 76.]

*Fibula, Right—Negligence.*—The plaintiff was knocked down by a pony, and had fibula broken. Damages £25. Incapacity for ten weeks.

[Catermole v. Watkins, Clerkenwell C.C., Judge Edge and jury. Local papers, May 19, 1908.]

*Ankle (W.C.A.).*—The workman on May 5, 1908, suffered from a fracture of the ankle. At the date of hearing, October 30, he was held to have been cured by September 22, 1908 (four and a half months). (See expert evidence for medical certificates in this case.)

[Harris v. White Star Line, Liverpool County Court, Judge Shand; 1908, *Post Magazine*, lxix. 999.]

*Ankle (W.C.A.).*—Incapacity. Fracture in the region of the ankle, tearing "the whole ligaments of the foot," in August, 1908. In March, 1909, seven months after, he complained of considerable weakness, and that moving caused him pain.

[Longhurst v. White, Dartford C.C., Judge Emden. Local papers, March 5, 1909.]

### Disease.

Inflammatory conditions arising after injury to the bone are in a very different category to fractures. The chief kinds are as follows: Periostitis, tumours, tuberculous and syphilitic inflammation of the bone. Syphilis is extremely common, and produces symptoms which closely resemble inflammation of the bone-sheath caused by an injury. It is said that the British nation, having no organized supervision over vice, and in consequence no control over "contagious" disease, is the most syphilitic in the world. Tuberculosis is also extremely common, but that more commonly attacks joints, under which head it will be again referred to. Tumours, and particularly sarcoma, are the most difficult point in connection with injury to the bone. The present state of surgical science, as far as one can understand it, seems to be this: Blows and injuries on exposed parts are necessarily very common. Sarcoma is infinitely less common than injuries, and it does not always appear in the parts of the body which are most exposed to injury; but anyone who has had a sarcoma can nearly always produce the story of some injury, serious or trivial. (See the article on Bones and Breast.)

**Ankle: Tuberculosis.**—The plaintiff fell from a tree on which he was clinging with climbing-spurs. The Court found as follows: "He is permanently injured, and will never have the free use of his limb and be able to follow his occupation. The accident made his leg or foot tuberculous, and, unless he follows careful medical treatment, it may cause his death."

[Demeule v. Quebec, etc., Electrical Company, Superior Court for the Province of Quebec, 1907, 32 S.C.]

**Hand: Bony Outgrowth.**—See below, Operation and Treatment.

### Operation and Treatment.

The consequence of refusal or neglect to submit to the proper treatment after injuries to bones has been before the Courts on several occasions. The correct treatment for the initial fracture, for the subsequent removal of a piece of separated dead bone, and for the overcoming of the stiffness, which is a common, if not the usual, consequence of the rigid position of the neighbouring joints during the healing of the fracture, have all been the subject of judicial decision. The following cases are all under the Workmen's Compensation Acts, as the editor has not been able to discover cases decided under other statutes or at Common Law.

The law of the subject is dealt with in a separate article at the commencement of this work, entitled "Operation," p. 24.

The following are cases where bones have been injured :

**Shoulder :** *Stiffness after Fracture—Due to not carrying out Treatment (W.C.A.).*—"A severe fracture of the shoulder happened to the applicant on October 25, 1898. In December, 1898, he was told by his surgeon to move his arm regularly. On March 27, 1899, the surgeons were of opinion that his incapacity was solely due to his neglect to follow the directions given him. In June, 1899, the joint was still stiff, and the applicant disabled from earning full wages. The County Court Judge found that the applicant was a man of very nervous temperament, and that this constitutional and natural nervousness, intensified to some extent by accident, was the reason why the applicant did not carry out the directions of the medical men, and this neglect had delayed his recovery, and was the cause of his present inability to work ; that is, neglect to obey the doctors was not the result of wilfulness or carelessness, but was due to the nervous condition, which he appeared to have been unable to control. The incapacity lasted eight months, and was still continuing when an award was made in his favour, which was upheld by the Court of Appeal."

[*Smith v. The Coed Taton Colliery Company, Ltd.*, 1900, *Times*, February 6 ; 2 W.C.C., 121.]

NOTE.—Recent decisions, as to what is "reasonable conduct" on the part of a workman, especially in connection with operations, would appear to require distinguishing from this case.

**Clavicle :** *Fracture—Untreated, "Unreasonable Conduct" (W.C.A.).*—The applicant, a domestic servant, fell down some cellar stairs when at work, and fractured her collar-bone. She was at once taken to Guy's Hospital, and His Honour found that she never went there again or had any further medical attendance. The bandages appeared to have become loose, and, as no restriction was put upon her movements, the broken ends of the bone, instead of uniting properly by bone, became attached by fibrous bands, the result being that she was still incapacitated from working three months after the accident. His Honour found that eight weeks was a reasonable time for complete union and recovery of full working capacity after a fracture of the clavicle, and awarded her compensation on that basis. He declined to allow her more, holding that her condition

was due to her unreasonable conduct in not attending the hospital for proper treatment.

[*Hearn v. Tunstall*, Southwark C.C., Judge Willis. Local papers, June 17, 1909.]

**Hand: Bony Outgrowth—Refusal to submit to Operation** (W.C.A.).—A small bony outgrowth on the bone at the base of the first finger, which is seen in Plates I. and II., prevented the injured man from working. On the advice of his medical man, he refused to have it operated upon. He was held to be reasonable.

The case was before the Courts on many occasions, and the following are the principal dates connected with it:

*February*, 1901.—Accident. The employer, Rothwell, agrees to pay 17s. 6d. weekly.

1902.—Employer requests him to submit to operation, the wounds being healed.

*February* 17, 1903.—Application to review on the grounds that the man should submit to operation.

*April* 24, 1903.—Unsuccessful appeal to Court of Appeal by employers.

*April* 19, 1907.—Further application to review and reduce. Application refused.

*January* 18, 1909.—Application to review. Award reduced to 7s. weekly on the grounds that he could now do light work.

*May*, 1909.—Unsuccessful appeal by the workman against this award.

In August, 1902, the wounds were entirely healed, but Davies said he could not hold a hammer for his work, because it caused pain to the palm of his hand. To cure this pain, several small operations were suggested, the really essential one being to remove a small pyramidal outgrowth of bone, attributable to the injury. This was found to be projecting from the side and front of one of the bones of the palm of the hand, at the base of the second finger. Plates I. and II. at the commencement of this book are X-ray photographs taken at different dates of Davies' hand: one is taken from the palm and one from the back, the smaller one showing the bone and pyramid at its natural size.

The exact nature of the injury is not mentioned in the Judge's notes, but it appears to be an outgrowth from the periosteum (sheath of the bone). Dr. Floyd said it was not due to "callus"—*i.e.*, the healing material thrown out after a bone has been broken or injured.

Dr. Floyd, as has been said, was throughout the case the principal witness in favour of the workman and against operations. It was the Judge's notes on his remarks which weighed so much with the Court of Appeal.

No one would attempt to doubt Dr. Floyd's skill or honesty, but had he been wrong in his advice, the consequences would have been very serious. Apart from other cases, the decisions in which were influenced by the result in this case, Davies, after drawing 17s. 6d. for eighteen months, has in addition, since the time he was asked to undergo operation—*viz.*, August, 1902—been paid 17s. 6d. weekly until January, 1909. Since that date, in spite of his appealing against the reduction, the amount has been reduced to 9s. weekly,

which he still receives for partial incapacity to work due to tenderness in the palm of his hand, which may be due to the pressure of his tools upon the small pyramid of bone or on a tiny nerve. Operation on both has been refused.

Dr. Floyd's original objection appears to have been solely to the risk of sepsis or infection—that is, (1) initial risk of local infection of the man's hand after operation; (2) the subsequent risk of that infection spreading.

At a later hearing it appears that a fresh objection was introduced, that the operation would do no good.

The editor has had the advantage of seeing both the Judge's and the shorthand notes of the arbitrations. The following are quotations from the Judge's notes, which are introduced here as being the basis of one of the most important decisions given on the subject of operation:

*February 17, 1903.*—Dr. David Harness (the medical referee for the district) advised the operation.

"An operation to remove this piece of bone ought to be performed. This would be a very slight operation, practically certain to succeed; the risk is a negligible quantity. . . . After the operation (the) hand would, in two or three months at the outside, regain its full capacity of movement without pain—another month to recover its full muscular power."

The risks of septic poisoning are very small—very minute risk where the surgeon inflicts the wound. This would be under ether, and risk very small indeed; but there is some.

Dr. Floyd: "In all probability operation successful, if man willing to undertake it; and would, if successful, improve his hand—might possibly cure it. I think the risk is small if the wound remains aseptic. That cannot be assured; there is a possibility of risk. . . . The least result of unsuccess would be festering matter forming, and this would incapacitate him for some time; would implicate tendons, and run up arm. There is very definite risk which cannot be eliminated, that might involve loss of hand, and possibly death. If operation performed, and was treated by all the best surgeons and with the best appliances, the risks are septic (*sic*) and the chloroform. These risks are common to all operations, but greater in some cases than in others. In this case it is greater. I would not on any account have this operation performed on me were my hand in this state. I have advised respondent to have it done under conditions—not otherwise. . . ." (the conditions being, apparently, the sharing of the risk by the employer). "I think, if the operation successful, it would incapacitate respondent for at least twelve months."

*April 19, 1907.*—Further hearing was held and further evidence was given.

Dr. Floyd: "(He) has recovered as far as he will recover, in my opinion. Very little, if any, difference since February, 1903. I think prevent(s) him from work as a first-class workman. Cannot know extent of his power till he does try. Nor would he know whether it would injure him or not. I think it would be harmful to him. Would set up neuritis or palsy; would be very great discomfort and pain at first. Wound healed by first intention."



January 18, 1909.—Further hearing and again more evidence.

Dr. Floyd: "Between April, 1907, and now there is no material change. I originally advised the man to have the operation spoken of. . . . I advised this some years ago, provided the employer would guarantee him against any further damage which might result to the hand as the result of the operation. This they refused to do. Therefore we did not have it done. I do not see that there is anything much to be gained by the operation, but I should not be adverse to its being tried, provided the parties that benefit by the operation divide the risk. I am not prepared to say there is not risk. Every operation has its risk, however small. . . ."

"The danger is in its becoming septic. Very rarely a wound becomes septic. There is no other risk of any importance. I do not deny it is remote. We run risk in coming into court."

[*Rothwell v. Davis*, 1903, 19 T.L.R., 423; 5 W.C.C., 141.]

**Finger: Fractured Bone badly set (Hypothetical Case).**—The point at issue was the unreasonable refusal to have a useless finger amputated.

M'LAREN, L.J.: "There is, of course, no question of compelling the party to submit to an operation. The question is, whether a party who declines to undergo what would be described by experts as a reasonable and safe operation is to be considered as a sufferer from the effect of an injury received in the course of his employment, or whether his suffering and consequent inability to work at his trade ought not to be attributed to his voluntary action in declining to avail himself of reasonable surgical treatment.

"In order to test the principle of the decision, I will suppose a more simple case. A workman whose trade requires the perfect use of both hands—a watchmaker or an instrument-maker, for example—has the misfortune to break one of the bones of the finger, and from want of immediate assistance, or it may be from neglect, the bone does not unite in the proper way. The hand is disabled, but he is advised that, by breaking the bone at the old fracture and resetting it, the use of his hand will be completely restored. I am supposing a case where the operation is not attended with risk to health or unusual suffering, and where the recovery of the use of the hand is reasonably clear. If in such a case the sufferer, either from defect of moral courage or because he is content with a disabled hand, and is willing to live on the pittance that he is receiving under the Compensation Act, refuses to be operated on, I should have no difficulty in holding that his continual inability to work at his trade was the result of his refusal of remedial treatment, and that he was not entitled to further compensation."

[*Donnelly v. Baird*, 1903, S.C., 536; 45 S.L.R., 394; 1 B.W.C.C., 95.]

**Toe: Dead Bone—Removal advised and refused (W.C.A.).**—A small piece of dead bone remained in the stump of an amputated toe. This prevented the man from working, and he was advised to submit to a simple surgical operation to have it removed. He refused, and the Court of Appeal decided he was unreasonable.

COZENS-HARDY, M.R.: "I cannot take that case" (*Rothwell v. Davies*) "as lending any support whatever to the suggestion that a

man may decline to submit to a trivial operation not involving any serious risk, but of such a nature that any reasonable man in his own interests would undergo it. I do not understand how anyone can doubt that under the present circumstances the true inference of fact is that the continuance of the incapacity is not due to the original accident, but is due to the workman's unreasonable refusal to take a step which any reasonable man would willingly submit to.

"In the present case I have the finding of fact by the learned County Court Judge, who says: 'All the medical witnesses called were of opinion that the applicant in his own interest ought to submit to the operation; the operation is of simple character, involving a risk which is hardly appreciable to a man thirty years old and in good health. The operation is one which any man of ordinary nerve would submit to in his own interest. . . .' In these circumstances, without saying, of course, that a man can be compelled to undergo an operation, I do say that a continuance of his disability will be due, not to the original accident, but to his unreasonable conduct in refusing to undergo this trivial operation."

FLETCHER MOULTON, L.J.: "In my view, a workman must behave reasonably, and if the incapacity or the continuance of the incapacity after a certain time is due to the fact that he has not behaved reasonably, then the continuing incapacity is not a consequence of the accident, but a consequence of his own unreasonableness. To hold the contrary would lead to this result: that a workman who had an injury, however small, might refuse to allow it to be dressed, and let a trivial wound become a sloughing sore, and lead to partial or total incapacity, for which his employers must compensate him. That is not the meaning of the Act. You cannot draw a line, in my opinion, between dressing and operation; that would be an entirely unreal and fictitious distinction. The distinction is between being reasonable and being unreasonable. . . . In *Rothwell v. Davies* there was a finding that it was reasonable for the workman not to undergo the operation. Here . . . the learned Judge . . . has found that it is most unreasonable for the workman not to undergo the operation."

FARWELL, L.J., also said: "In my opinion it was as much a question of fact for the County Court Judge whether the incapacity was due to the accident or to some other causes, as it was to decide whether the original incapacity was due to the injury. Lord M'Laren has expressed my view exactly." (Lord M'Laren's judgment is given above.)

[*Warncken v. Richard Moreland and Sons, Ltd.*, 1909, 1 K.B., 184; 2 B.W.C.C., 350.]

## BRAIN.

The recognition of the presence, and still more of the locality, of an injury to the brain is often extremely difficult, especially when the damage does not touch one of the motor areas. In addition, there are many conditions of disease, especially those of syphilis, tuberculosis, and old arterial degeneration (atheroma), which may produce symptoms alleged to have been caused by an accident.

Inflammation caused by disease or injury to the head, but not affecting the brain, is apt to spread to it; for example, inflammation of either the ear, throat, nose, or eye, has been known to infect the brain, leading to the production of meningitis, and eventually even abscess. Inflammation of the ear is exceedingly common in children after measles, and among the uneducated a discharge often continues for years. When an abscess of the brain arises from such a cause, dizziness may be one of the symptoms, and this easily produces a fall or accident. Under such circumstances the abscess causes the fall, and not the fall the abscess.

### Epilepsy.

Epilepsy is exceedingly common in both forms. In the minor form, or *petit mal*, consciousness is lost for a short period, during which the man may perform involuntary, and sometimes compromising, acts. The classical instance of such an act, in this disease, was that of a Judge, who, being a sufferer from this minor form of epilepsy, rose from the judicial bench, and, apparently sensible, but really in a state of unconsciousness, voided his urine in a corner of the court.

In major epilepsy, or *grand mal*, in addition to unconsciousness, convulsions occur. Injuries are common during a fit, for the sufferer may fall into the fire and be burned, or be suffocated in his pillow, as he is in a condition of total unconsciousness and insensibility to pain. Epilepsy may be either the cause of an accident or be produced by injury to the brain.

### Epileptic Fit causes an Accident.

*Fit causes Death from Railway-Train* (Insurance).—Exact words of policy: "Payment only in case of injuries accidentally occurring from material and external cause operating upon the person of the insured, where such accidental injury is the direct and sole cause of death to the insured . . . but it does not insure in case of death arising from fits . . . or any disease whatsoever arising before or at the time or following such accidental injury (whether consequent upon such accidental injury or not, and whether causing such death directly or jointly with such accidental injury)."

The insured was seized with a fit when upon a platform, from which he fell on to the line, and a passing train killed him.

DENMAN, J.: "Death arose from the engine destroying the insured by coming across him."

Held: "That the death was caused by an accident within the policy.

[Lawrence v. Accident Insurance Company, 1880, 7 Q.B.D., 216.]

*Fit causes Death by Drowning* (Insurance).—Words of the policy: "Receive or suffer bodily injury from any accident or violence . . . provided that no claim should be payable in respect of death by accident or violence unless such death should be occasioned by some external and material cause operating upon the person of the insured."

Insured, whilst bathing, became insensible from "some unexplained internal cause," and was drowned by falling unconscious, face downwards, in a shallow pool.

WILLIS, J.: "The death resulted from the action of the water on the lungs. . . . The fact of the deceased falling in the water was an accident."

Held: "An accident within the policy."

[*Reynolds v. Accident Insurance Company*, 22 L.T., 820; 18 W.R., 141.]

*Fit causes Death by Drowning* (Insurance).—Words of policy: "Any personal injury caused by accidental, external, and visible means, and the direct effect of such injury shall occasion his death . . . but not to extend to any injury caused by or arising from natural disease or weakness, or exhaustion consequent upon disease."

Deceased, while crossing a stream, was seized with a fit, and fell into the stream and was drowned.

LORD COLERIDGE: "The death was not caused by any natural disease or weakness, or exhaustion consequent, but by the accident of drowning."

Held: "An accident within the policy."

[*Winspear v. Accident Insurance Company*, 1880, 7 Q.B.D., 42.]

*Fit causes a Fatal Fall* (W.C.A.).—A workman was subject to epileptic fits, and while at work on board ship he had a seizure, with the result that he fell down the hold of the ship and was seriously injured.

In the course of the hearing a number of insurance cases were quoted, and the following judgment in the Court of Appeal referred to these:

COLLINS, M.R.: "The Court looked (in those cases) at the *causa proxima* of the death, and found in one case it was death by drowning . . . in another case that it was a case of death by being run over by an engine. In both those cases the Court regarded the accident as consisting of the fact that the seizure overtook the man at a place where the fall resulted in the accident. . . . (Here) the approximate cause was the fall from the height above to the place where he was found. . . . The original cause of the fall was a fit; the fall itself was an accident. . . . By the conditions of his employment he was bound to stand in close juxtaposition to the hold of the ship . . . on the edge of what I may style a precipice. . . . The accident was caused by the necessary proximity to the precipice, for the fall was brought about by the necessity of his standing in that position."

COZENS-HARDY, L.J.: "If I could adopt the argument that an employer is not liable for the remote consequences of any disability which the workman might bring with him, I might arrive at a different conclusion, but I think the true view is this—that a workman brings with him to his employment certain disabilities. They may be disabilities of age, and they may be disabilities of infirmity in connection with age. . . . The accident arises out of the employment none the less because the remote cause is an infirmity in his physical condition."

[*Wilkes v. Dowell*, 1905, L.T., 577; 1905, 2 K.B., 225; 74 L.J., K.B., 572; 21 T.L.R., 487; 53 W.R., 515. W.C.C., 14.]

*Fit causes Fall and Subsequent Death* (W.C.A.).—An epileptic had a fit while at a temporary latrine. He fell into the trench, and when

he got out he was covered with filth. He could not speak, and died the same day.

The medical evidence was that he would probably have recovered from the epileptic fit if he had not fallen into the filth.

Held: "An accident."

[*Porton v. The Central Unemployed Body for London*, 1909, 1 K.B., 773; 2 B.W.C.C.]

### Epilepsy caused by Injury to the Brain.

*Epilepsy: Fracture of Skull* (W.C.A.).—On March 4, 1907, Butt, who was an ostler employed by a colliery company, was riding a frisky horse. When passing quickly through a doorway, he knocked his head against the top of the doorway. He returned to work the next morning, and continued at work till March 12. He was then absent from work for two or three weeks. In February, 1908, he was away from work for a short time. On November 7, 1908, the workman died from epilepsy. On a post-mortem examination, a piece of skull was found to be detached and embedded in the lining of the brain of the deceased. The medical evidence was that this bone, pressing on the brain, produced epilepsy, and that the death was due to this accident.

[*Butt v. Gellyceidrim Colliery Company, Ltd.*, 3 B.W.C.C., 44.]

### Coverings of Brain.

*Traumatic Meningitis* (Manslaughter).—On November 13, 1906, the prisoner seized his child, then a baby of three months old, by the legs, and flung it down and beat it into a condition of unconsciousness. Shortly afterwards its skull was found to be fractured. For this assault he was prosecuted at the Salford Borough Police-Court under the Prevention of Cruelty to Children Act, and sentenced to four months' imprisonment.

On December 29, 1907, the prisoner was heard to beat the child, and the following morning its face and head were found to be severely bruised. For this assault he was also prosecuted at the police-court on January 18, 1908, and sentenced to six months' imprisonment.

On February 17, 1908, the child was admitted into the hospital suffering from traumatic meningitis, from which it died on March 5, 1908. At the time of its admission into the hospital all external marks of violence of the previous December 29 had disappeared. The medical evidence went to show that the fracture of the skull in so young a child would necessarily cause some destruction of the brain tissue, and eventually death, though the child might possibly live with such a fracture for some few years; that the fracture was the main cause of the child's death, but that the subsequent acts of violence, if they took place, would accelerate the death.

[*Rex v. Dyson*, 1908, 2 K.B., 455.]

NOTE.—This case is given as an extraordinary example of serious symptoms appearing when a long interval of time has elapsed after the injury.

### Vessels of the Brain.

*Hæmorrhage from the Middle Cerebral Artery* (No evidence as to cause—W.C.A.).—A workman died, and at the post-mortem was found to have had bleeding from the middle cerebral artery, "which might have been caused by a blow upon the head, but that there were no external indications of any blow."

On August 31 deceased came home very white and unwell, vomited, and was sleepy and drowsy from that time until his death. He complained of pain in the head. He contrived to work for a fortnight after the accident, came home on September 15 after his work, ate a good meal, immediately afterwards vomited, and went into another room, where in a few minutes he was found unconscious on the floor, with "slow and stertorous breathing due to compression of the brain, and was blue at the time." Post mortem it was found that the middle cerebral artery had been burst.

COZENS-HARDY, M.R.: "All the evidence . . . goes to show that, although it was consistent with apoplexy due to a concussion, it was also quite consistent with apoplexy caused by some other circumstances."

Held: "There was no evidence to show how apoplexy arose, whether knocking his head upon the lintel of the door as alleged or not."

[*Wolseley v. Pethick Brothers*, Court of Appeal, 1 B.W.C.C., 411; Kingston County Court, Dep. Judge. Local papers, January 11 and 18, 1908.]

*Cerebral Hæmorrhage (Apoplexy) from Arteries already Diseased* (W.C.A., Scottish).—A workman engaged in his ordinary and usual work became suddenly giddy, and lost power in the right leg and arm. This was diagnosed as slight cerebral hæmorrhage. The symptoms all passed off, but he remained at home, in bed, where he had a second attack, causing complete paralysis of one side. His arteries were already diseased, the walls being hard, so that an attack of hæmorrhage was likely to occur.

LORD M'LAREN: "It is the giving way of an artery causing effusion of blood on the brain, and I am unable to see any distinction between this kind of physiological injury resulting in disablement and the kind of injury we had to consider in the case of *Stewart*.\* The logical deduction from the evidence is that the man's improvement was only a partial recovery from the first attack, which was caused by the arteries of the brain being in a strained condition in consequence of over-exertion, and that this second attack was a further development of the injury he suffered from over-exertion."

LORD KINNEAR: "This man suffered from bursting of a blood-vessel while trying to lift a weight too heavy for him. That it might or might not have been too heavy for a man whose arteries were in a sound condition is nothing to the purpose."

Held: "The man received an injury by accident within the meaning of the Workmen's Compensation Act."

[*M'Innes v. Dunismuir and Jackson, Ltd.*, 1908, 45 S.L.R., 804; 1 B.W.C.C., 226.]

\* See below, Case Guide—Muscles.

*Cerebral Hæmorrhage after Injury to a Foot* (W.C.A., Scottish).—On May 4 a stone fell on Warnock's foot, and he went home and rested it. "His physical condition generally was lowered by the accident, and it never entirely recovered."

On June 3 he went back to work till June 17, when his voice was noticed to be shaky, and he said he had had a slight "attack" a few days before. On June 17 he was taken ill in the pit, and found unconscious; he recovered somewhat, went home, and died on June 27 of a stroke of apoplexy (cerebral hæmorrhage).

Held: "Not proved that death resulted from or was accelerated by the accident."

[*Warnock v. Glasgow Iron Company*, 1904, 6 F., 474.]

*Paralysis from Lead*.—*Vide infra*, Poisons—Lead, p. 1047.

### Brain Substance.

*Concussion of Brain* (Insurance).—Exact words of the policy: "Against bodily injuries, sustained through external, violent, and accidental means, if death results from such injuries within ninety days therefrom, independently of all other causes."

The insured left home after breakfast, and returned about ten o'clock, telling his servant that he did not feel well, that he was dizzy and was going to lie down. His servant brought him a cup of tea, and helped him to carry a gas-stove into his room. He was never again seen alive. At twelve o'clock his wife found him dead on the floor (polished hard wood, recently damped). His head was on the fender, and the rug at his feet was displaced. There was blood on the fender, blood round his nose, and a bruise at the base of his neck.

Medical evidence: That his previous general health had been good; that death was caused by concussion of the brain.

Held (on appeal): "There was evidence enough to justify the jury in finding death was due to 'external, violent, and accidental means,' and not from vertigo, from which there was no evidence the deceased had ever suffered."

[*Larkin v. Inter-State Casualty Company*, Supreme Court, Goodrich, P.J., New York, 43 App. Div., 365.]

*"Softening of Brain" following an Injury to Eye* (W.C.A., County Court).—On February 7, 1903, Mitchell met with a serious injury in his right eye, and a slight injury to his left eye, so that ultimately he became blind. After some months his mind became affected, and he died in November, 1904, from "softening of the brain." Judge Parry on the medical evidence found that the death was not due to the accident itself, but was indirectly caused by the accident, which set up such a condition of things that the man subsequently died. The injury to the eye caused the blindness, and the blindness produced the condition of the mind upon which softening of the brain supervened.

Held: "The death resulted from the injury, which was an accident."

[*Mitchell v. Grant and Aldcroft*, Salford C.C., Judge Parry; 1905, 118 L.T.J., 462.]

*Injury to Brain—Mental Condition after* (W.C.A., County Court).—On February 25, 1908, a workman had a very serious accident: his skull was not fractured, but his brain was injured, as an operation was necessary to let out blood, and at the time of hearing, January 12, 1909, he still had a trephine hole in his skull. There was paralysis of right side of face and right arm at time of accident, which improved, but at the hearing of the arbitration slight impediment of speech, slight limp, weakened hand and leg, remained. On May 22, 1909, the insurance company agreed for full settlement for £30.

The Judge found that the company had approached Davis when he was still suffering from the effects of the injury to the brain, which was likely to be severe, and that he was without independent advice. "Improper means" are not *ejusdem generis* with fraud, but equivalent to "unfair." He was told the utmost the insurance company could pay was £30. This was not a fact.

Held: "Improper means."

[*King v. Davis*, 1909, Bristol C.C., Judge Austin; *Policy Holder*, xxvii. 73.]

*Insanity after Brain Injury.*—*Vide infra*, pp. 976, 977.

*Cerebellum* (W.C.A., County Court).—In 1900 a ratchet bolt fell on the head of the applicant, who was incapacitated, and in consequence received 18s. 10d. a week until March, 1908.

He was then over sixty, and was offered light work as painter. Drs. Finucane and Hastings said he was then suffering from giddiness, loss of memory, and arterial disease, which they considered were not connected with the accident, but were due to the rather rapid approach of old age. Dr. Aaron Reed said that this giddiness, headache, and staggering, were incurable, and that the man's defective eyesight was perfectly typical of a blow on the cerebellum, and that the symptoms were "due to the effects of the accident entirely."

This was supported by Dr. Lauzun Brown.

[*Gas Light and Coke Company v. Pope*, Bow C.C., Judge Smyly, Local papers, March 7, 1908.]

*Alcohol.*—For diseased condition of brain caused by alcohol, see Alcohol, p. 865 (*Connell v. Barr*).

*Brain Injury.*—See also Bones, p. 881: Fractures—Damages, Head (*Floyd v. Gibson*).

### Operation.

*Skull Fracture: Refusal of Operation—Trephining for Old Fracture* (W.C.A.).—In April, 1908, a heavy roller-blind fell upon and cut the head of a workman, who was at once taken home and seen by a doctor. At the end of a week he returned to partial work, at which he continued on and off for two months, with intervals at home, under Dr. Bebb.

He worked, apparently at full work, from June to December, 1908, when he gave up, and again went to Dr. Bebb.

From December, 1908, to June, 1909, he attended the London Hospital under Dr. Head and Mr. Openshaw, who apparently advised that he should undergo an operation to his head.



At the hearing of the arbitration, in October, 1909, he said that since the accident he had suffered from dizziness, shooting pains in the head, loss of memory, and sleeplessness.

Dr. Bebb said the injured man was first seen by him on May 21, 1908, about a month after the accident. The following is his evidence, quoted verbatim from the Judge's notes:

"I thought his headache, giddiness and buzzing noise, and inability to sleep, due to fracture of the bone of the skull. The cut would be near to the middle line, under the hair, about  $1\frac{1}{2}$  inches long, just along the parting, a little to the left side. From time to time seen him since that, always complaining of giddiness, buzzing noise, and sleeplessness.

"I cannot fix date when I suggested he should see Mr. Openshaw. I gave him a letter to give to Mr. Openshaw. Mr. Openshaw sent me an answer. I came to the conclusion it was due to a fracture. After that he attended London Hospital. He used to come to the surgery and tell me how he was doing. I used to examine him.

"There is a loss of power in left arm and grasp of hand less firm, and the tendons of the left arm contracted. Loss of power in left leg; this I take from his statement.

"The left eye also droops—all mischief in the left side. All this agrees with the history.

"The buzzing has puzzled me; my opinion was that it came from a fracture at the base of the skull, which lets in a little air through the back of the nose (*sic*).

"The man has deteriorated since he has come under my notice. He was a burly man; I should say he has lost 2 stone. Unless there is an operation I think he will get worse. I advised him to have the operation—in good hands not dangerous, but one cannot guarantee success."

In cross-examination he said: "First saw in May, 1908. I do not know if the buzzing was the right or the left ear. The pressure on the frontal bones causes the paralysis on left side. The injury, though on the left side of head, is near the middle line. I have never known of an injury on the left side of the head causing paralysis on the left side. I saw him three days running; came now and then, a dozen times between May and end of year; he complained of giddiness, headache, and want of sleep. These I have to accept from the patient.

"Loss of power on left side; that I do not take from patient, except so far as the leg, where there is no obvious sign.

"The left arm I judged from the grasping power.

"That would depend on the patient, if the man comes with the object of deceiving you; the contractions of the tendons I can see. I did not know of the contractions of the tendons before the end of last year, after he first came to me; this has got much worse since then. I know that he came to me about the end of August.

"In August, as far as giddiness, headache, and insomnia, much the same as now.

"Remove part of skull round scar is the nature of the operation; no reasonable danger in hands of competent man. If this had been done at once, I think it would have been a success, except the buzzing noise, which he has always complained of."

Held: "The refusal to be operated upon is not unreasonable, as it was not clear that it would cure him, it being at least doubtful if it would cure the buzzing sound."

Upheld by the Court of Appeal.

[*Hawkes v. Coles*, Bow C.C., Judge Smyly. From the Judge's notes, dated October 25 and November 17, 1909, and 3 B.W.C.C. 163.]

### Shock, Hysteria, Neurasthenia, etc.

For cases of injury to the brain producing any one of the above, see below, Neurasthenia.

### BREAST.

As every woman at some period of her life has had a blow, either trivial or severe, upon the breast, it is not a difficult thing to convince the Court, rightly or wrongly, that any inflammation of the breast arises after an injury. As Mr. Bland-Sutton states above, in the article on the Breast, carcinoma (scirrhus) is very common, and probably not due to an accident. Sarcoma is less common, and may be due to an accident.

[See below, note to case of False Neurasthenia, p. 1033.]

### BURSÆ.

See Beat Hand, Beat Knee.

### CAISSON DISEASE.

**Caisson Disease as Defence** (W.C.A.).—The workman was struck on the head by a piece of wood in February, and claimed that he was still suffering from headache and ear trouble. The defence was that he had worked for some years, in compressed air, making sewers, and that he was quite cured of this accident on February 22, when he received £3 in full settlement. He was awarded a further £5 in final award, the Judge apparently holding that his symptoms were due to compressed-air disease.

[*Blowes v. The Walthamstow Council*, Bow C.C., Judge Smyly, Local papers, May 23, 1908.]

### CHILDREN.

#### Medico-Legal.

The medico-legal cases on children who have suffered from personal injury to the body show that in many instances the damages awarded to them are smaller than those awarded to adults. It almost seems as though the amount of damages was proportionate to the size of the child. For example, see *Floyd v. Gibson*, on p. 881, under Bones: Damages, Skull, where a child, for the most fearful and painful permanent injury to its head and other parts, received less compensation than an adult would for the loss of his left hand.

The immense importance of injuries affecting the growing line of

the long bones of the limbs cannot be over-estimated, for an injury of this spot, as Dr. Kellock points out, may stop the growth of the bone. As this may lead to the child growing up as a cripple with three or even more inches' shortening of the limb, the amount of damages payable should be very heavy, but we have at present been unable to find any reported case of this injury ("separation of the epiphyses," as it is called). Several cases of sudden death caused by the presence of the "lymphatic diathesis" have recently been before the public, in one of which the administration of anæsthesia was an important feature. Dr. Kellock does not appear to have mentioned this malady, but it might at any time have a bearing upon a criminal charge, or even upon a claim for damages, if such could arise through the death of a child.

### Law.

The law gives to persons under twenty-one a privileged position. This differs, however, according as the particular relationship of the infant to other persons from which litigation has started depends upon a contract or a tort. This is especially well marked where the relationship between the defendant and plaintiff was that of master and servant. The employment of an infant at dangerous work throws upon the master more than the usual degree of duty to teach the workman how to use the machine with safety, as the instruction must be intelligible to an infant's mind. A further special position is created under the Workmen's Compensation Act.

### Procedure.

When it is intended to rely on infancy as a defence, this must be specially pleaded.

An infant sues by his next friend. It is still considered to be the infant himself who is suing for damages to himself only; so that damages claimed for losses by the parent or other next friend cannot be awarded as part of the infant's damages. Among such damages cannot be included the necessary medical attendance paid for by the father.

A child was bitten by a dog, and by his father as next friend sued for damages, including the amount of the medical fees paid by his father.

Held: "These are not recoverable in this action—*secus* if it had been the infant's own money."

[*Collins v. Lefevre, Coleridge, J.*, 1858, 3 F. & F., 436.]

### Insurance.

The cases relating to insurance policies effected upon the lives of infants are outside the scope of this book. An insurance policy entered into by an infant will come within the law of contract.

### Negligence.

Tortious acts in relationship to an infant may be those of the infant against other people, or of other people against an infant.

An infant is liable for his torts, but the tort must be independent

of a contract, unless the tortious act of the infant, though arising out of a contractual relationship, is something entirely beyond the boundary of the contract. The negligence of a child has to be treated as that of a child, and the contributory negligence or even trespass of a child comes within the same category.

The exact effect of the cases deciding the position of an infant, where the torts of others have caused injury to him, is somewhat hard to follow, but the principle which can be deduced from them appears to be as follows :

The actions of an infant cannot be judged by the same standard as those of an adult ; and in consequence infancy—by that is meant any age under twenty-one—denotes some mental deficiency entitling the infant to special consideration. Even if the infant is as old as twenty, he still is entitled to the protection of the law of infancy, and a girl of seventeen has been described by a Judge as of “tender years.”

If an infant is injured while doing something wrong, especially when trespassing, he may still recover damages for the injury, but apparently only under the following two conditions : Either the defendant has been guilty of negligence by his acts, which include tempting or inviting the child to run the risk, or he must have committed a breach of duty which was the cause of the injury.

But if the defendant is not guilty of either of these offences, there is no liability upon him for the injuries sustained by the child, who is then liable for the consequences of his own naughty or tortious acts, including those due to his own negligence. But an infant of tender years cannot be guilty of contributory negligence.

CHANNELL, B. : “The doctrine of contributory negligence does not apply to an infant of tender age. To disentitle the plaintiff to recover, it must be shown that the injury was occasioned entirely by his own negligence” (*Gardner v. Grace*, 1 F. & F., 359).

It is not proposed to quote here the cases where, at the time the injury was sustained, an infant was under the care of an adult.

### Children injured by the Negligence of Others.

*Injury by playing with an Unattended Cart and Horse—Invitation.*—Nurdin’s man left a cart and horse for half an hour unattended outside a house in a London street where children were likely to be. During this time Lynch, a small boy, with others of his kind, started climbing into the cart and out of it. While the plaintiff was getting down from it, another boy made the horse move, in consequence of which the plaintiff fell and his leg was broken, for which he recovered damages, in spite of the defence of contributory negligence.

DENMAN, C.J., in his judgment says : “It was an action for tort for negligence by the defendant’s servant in leaving his cart and horse half an hour in the open street. . . . But the question remains, Can the plaintiff then, consistently with the authorities, maintain his action, having been at least equally in fault? The answer is that, supposing that fact ascertained by the jury, but to this extent, that he merely indulged the natural instinct of a child in amusing himself with the empty cart and deserted horse, then we think that the defendant cannot be permitted to avail himself of that

fact. The most blamable carelessness of his servant having tempted the child, he ought not to reproach the child with yielding to that temptation. He has been the real and only cause of the mischief. He has been deficient in ordinary care; the child, acting without prudence or thought, has, however, shown these qualities in as great a degree as he could be expected to possess them. His misconduct bears no proportion to that of the defendant which produced it. For these reasons we think that nothing appears in the case which can prevent the action being maintained."

[*Lynch v. Nurdin* (on appeal), 1840, 1 Q.B., 29.]

PARKE, B., commented on the case as follows: "The decision in *Lynch v. Nurdin* proceeded wholly upon the ground that the plaintiff had taken as much care as could be expected from a child of tender years—in short, that the plaintiff was blameless, and consequently the acts of the plaintiff did not affect the question" (*Lygo v. Newbolt*, 1854, 9 Ex., at p. 305).

*Injury by falling into a Cellar through a Bar across the Opening giving way—Invitation.*—The defendant, a scene-painter, was working at his trade in a cellar opening on to a crowded street. He protected the cellar opening by a bar, upon which the plaintiff, a small girl, leaned, to observe him executing his work. The bar gave way; the child fell, and was injured. She successfully sued the defendant for damages for her injuries.

ESHER, M.R.: "There was painting going on in the cellar. It must have been known it would attract children; and then a bar was put up, ostensibly for the purpose of protection, against which children would naturally lean while looking down into the cellar where the painting was going on. That was almost an invitation, certainly an inducement, to the children to lean against the bar while looking down into the cellar."

[*Jewson v. Gatti* (on appeal), 1886, 2 T.L.R., 441.]

*Injury by climbing a Fence which was Rotten, and consequently a Nuisance.*—The defendant was under a duty to keep an efficient fence by the roadside; in fact, the fence was rotten and a nuisance. The plaintiff, a small boy four years old, came along the road, and climbed on the fence to see some other boys playing on the other side. The fence fell and injured him. It was considered that the boy was indulging in "the natural instinct of a child" in climbing the fence, and that the defendant failed in his duty in having a fence which was rotten, and consequently a nuisance, and that he should have calculated on such a probable event as a boy climbing on it.

[*Harrold v. Watney* (King's Bench), Ridley, J., and common jury (on appeal), 1898, 67 L.J., Q.B., 771.]

### Children injured through their own Fault.

Decisions founded on the negligence of children are not only contradictory with some of those given above, but have even been contradicted by later Judges.

*Machine exposed, unattended, in a Public Market-place; Child injured when playing with it—Negligence.*—A crushing machine exposed on view in a market-square was discovered by some small boys. One of them put his fingers in the cogs, while another turned the handle. Having had three fingers cut off, the plaintiff sued the owner of the machine for negligently exposing it in a public place where little boys would be likely to play with it. In the County Court the jury gave £10 damages, but on appeal this was reversed.

BRAMWELL, B.: "The defendant . . . had a perfect right to exhibit his goods, and is not liable for the effects of an accident caused by the improper meddling of the plaintiff and his companions."

[*Mangan v. Atherton* (on appeal), 1866, 35 L.J.Ex., 161.]

NOTE.—This judgment was emphatically disapproved of by Cockburn, C.J., in the following words: "It appears to us that a man who leaves in a public place, along which persons—and amongst them young children—have to pass, a dangerous machine . . . is not only guilty of negligence, but of negligence of a very reprehensible kind" (*Clarke v. Chambers*, 47 L.J., Q.B., at p. 434).

*Trespasser on a Railway-line—No Negligence of the Railway Company.*—A child aged three years and a half trespassed on a railway-line, and while she was sitting on a bridge, where she had no right to be, a train came by and cut off her leg. The railway company was sued for damages.

Held: "In the absence of any default on the part of the railway company, or evidence that the child got on the bridge through some neglect on the part of the railway company, they were not liable."

[*Singleton v. Eastern Counties Railway Company*, Common Pleas, Westminster, Erle, C.J., 1859, 7 C.B., N.S., 287.]

NOTE.—Had there been a duty in the railway company to fence, and had the child been able to enter through a breach of that duty, this decision would probably have been the very opposite (see *Williams v. Great Western Railway*, L.R., 9 Ex., 157).

*Interference and playing with Unfastened Cellar Flap.*—A child of seven was amusing himself by jumping on and off a movable wooden cellar flap which had been placed against the wall. In doing so he was injured.

POLLOCK, C.B.: "Had he been an adult it is clear he could maintain no action; he would voluntarily have meddled, for no lawful purpose, with that which, if left alone, would not have hurt him."

Held: "He is entitled to damages."

[*Abbott v. MacFie* (on appeal), 1863, 33 L.J.Ex., 177.]

*Infant falls into Unfenced River—No Duty to fence.*—An infant fell into the River Kelvin, in the Botanic Gardens, Glasgow, a public park. The gardens were well known to be a resort of children. The parent claimed damages for the loss of his child.

LORD M'LAREN: "Now, as the common law is just the formal statement of the results and conclusions of the common sense of mankind, I come without difficulty to the conclusion that precautions

which have been rejected by common sense as unnecessary and inconvenient are not required by law. If it could be shown that there was any special danger at the place where the child fell into the water, the case would be different." He held there was no duty to fence.

Held: "There being no negligence, there was no liability."  
[Sheen v. The Corporation of Glasgow, 1908, S.C., 1034.]

### Negligence arising out of the Relationships of Master and Servant.

As has been said above, it is the master's duty to instruct his servant how to use machinery or perform his duties, when without that instruction danger would be incurred.

If the master is sued at common law, and not under either the Employers' Liability Act or the W.C.A., then this liability for negligence on the part of the master may be entirely repudiated by the defence of common employment. This is a good defence where the master has employed a competent foreman to instruct the infant, and it is proved that it was the neglect of the foreman so to instruct that was the real cause of the injury.

*Dangerous Machinery—Insufficient Instruction* (Common Law).—An infant girl under sixteen years of age was put to work at a straw-plaiting machine containing many rollers which were driven by steam-power. Her arm was caught in the rollers and had to be amputated. Damages £150.

COCKBURN, C.J.: "If the owners of dangerous machinery . . . employ a young person about it quite inexperienced in its use . . . without proper directions as to its use . . . as it is their duty to take reasonable care to avert such danger, they are responsible for any injury . . . from the use of the machinery."

[Grizzle v. Frost, Cockburn, C.J., and jury, 1863, 3 F. & F., 622.]

*Dangerous Machinery—Insufficient Instruction* (Common Law).—A girl aged seventeen was told to fill soda-water bottles, and was injured by the explosion of one of them. Explosions were a common occurrence, and she was given a mask to wear to protect her face. She sometimes wore the mask. She sued for damages, and recovered £50, and the employer appealed.

ESHER, M.R.: "Having regard to the tender age of the person employed, the jury were justified in thinking that it was not sufficient for the defendant to provide masks, but that it was his duty also to point out to such young people the existence of the danger, and to insist on their wearing masks.

"This he had failed to do, and the jury might well say he had been guilty of negligence. Then, was the plaintiff guilty of contributory negligence in not putting on the mask? She had sworn that she did not know of the danger, or that it was necessary to wear the mask. . . . It was not negligent for a girl of her age to omit to put on the mask if she did not know that she was bound to do so."

[Croker v. Banks (on appeal), 4 T.L.R., 324.]

*Selling Newspapers at Railway-Station—Insufficient Instruction as to Danger* (Common Law).—The plaintiff, a lad of twelve, was employed in selling newspapers at Walsall Railway-Station. He received an injury while using a familiar short-cut which he and other boys not infrequently used. The occupation was dangerous; there was a duty to warn the boy of the danger he ran.

WILLS, J.: "Everyone knew that if boys were not well watched they would get themselves into danger when there was an opportunity of doing so. . . . One knew that boys were certain in some cases to be ambitious to try to get a reputation for smartness."

[*Robinson v. W. H. Smith and Son*, 17 T.L.R., 422.]

*Dangerous Machinery—Common Employment: Delegation to Foreman of the Duty of the Employers to instruct* (Common Law).—A lad of fifteen was injured by his arm being caught in a circular saw. The foreman whose duty it was to instruct had failed to give the necessary instruction as to the working of the machine.

Held: "Though the defendants would have been liable for neglect to instruct the infant, yet, as they had delegated the duty to a competent foreman, they were not liable for the injury caused by the negligence of the foreman, who was in common employment with the injured infant."

[*Young v. Hoffmann*, Chelmsford Assizes, Ridley, J., and common jury (on appeal), 1907, 2 K.B., 646.]

*Dangerous Work—Common Employment* (Common Law).—A child of fifteen was loading cartridges under a forewoman whose duty it was to instruct her how to do it, and the danger arising therefrom. The forewoman failed to instruct her. A cartridge exploded, so that the child lost her right eye.

The County Court Judge awarded her £300.

Held: "Common employment was a good defence."

[*Cribb v. Kynoch*, appeal from Waltham Abbey C.C., Judge Tindal Atkinson, 1907, 2 K.B., 548.]

### Contract.

The general tendency of the law is to protect the infant from the consequences of making foolish contracts. The rule is that a binding contract cannot be made with an infant unless it is for his benefit or for necessities. The question what is a "necessary" depends on the social status of the infant, and on the quantity of similar goods which he already possesses; drugs and surgical appliances would be reasonably included in the category of necessities. The law on the subject depends on various Acts of Parliament and decided cases, and whether the contract is for the benefit of the infant or not is a question for the Court to decide after "a careful examination of its terms." A considerable number of cases on this point have already been recorded, some of which are quoted here. Those under the W.C.A. will be separately dealt with, but they are equally illustrative of the point.



*Infant's Benefit—Contract of Insurance replaces Rights under the Employers' Liability Act.*—An infant entered into a contract of service with the London and North-Western Railway Company, agreeing to accept an insurance against accidents in lieu of his rights of action under the Employers' Liability Act. In spite of the fact that he would probably have recovered more damages under the Act than he would be entitled to under the insurance, it was held to be a contract for his benefit, and he was bound by it.

[*Clements v. The London and North-Western Railway Company*, 1894, 2 Q.B., 482.]

*Infant's Benefit—Contract for Carriage by Rail, releasing the Railway from any Claim for Personal Injury.*—An infant under certain conditions contracted with the London and North-Western Railway Company for a free pass on condition that he should not claim damages for any personal injury sustained through the negligence of the railway company.

Held: "A contract not for the benefit of the infant."

[*Flower v. London and North-Western Railway Company*, 1894, 2 Q.B., 65.]

### Workmen's Compensation Act.

(i.) **Contracting out**—*Infant contracting out* (W.C.A., County Court).—Morter, a workman, was a minor. At the age of seventeen he entered into the service of the Great Eastern Railway, and joined a contracting-out scheme which was duly certified by the Registrar of Friendly Societies under the Workmen's Compensation Act. By accepting this scheme he released his employers from their liability under the Act. He contributed a penny per week to the fund for about two years, and then his left foot was so badly crushed that his leg had to be amputated below the knee.

His Honour Judge Mulligan considered the contracting-out scheme, as to whether it was to the benefit of the infant, and he found that it was not, and applied the rule of law under which a contract by an infant is not enforceable unless the Court is of opinion that it is for his benefit.

[*Morter v. The Great Eastern Railway, Norwich C.C.*, Judge Mulligan, K.C.; *Policy Holder*, January 27, 1909.]

(ii.) "**Option.**"—Under the Workmen's Compensation Act, 1906, there is an option given to an injured workman to proceed either independently of the Act or under it, and on behalf of the infant this option is exercised by a "next friend"; but the option is not binding unless it be for his benefit. The same kind of option existed under the 1897 W.C.A.

*Option—Not for Benefit* (W.C.A.).—An infant signed a receipt agreeing to accept 2s. 6d., being half his weekly wages, which was all that he was entitled to under the W.C.A., 1897; and, in spite of this agreement, he then brought an action at Common Law. It was held that the option he had exercised was not for his benefit as an infant, and that he was entitled to rescind it and to sue at Common Law. This he did, and recovered £75 damages for the loss of the

three fingers of his left hand, on account of the negligence of his employers.

COLLINS, M.R.: "The ordinary law was that an infant was not bound by a contract made by him which was not for his benefit."

[*Stevens v. Dudbridge Ironworks Company*, 1904, 2 K.B., 225; 6 W.C.C., 48.]

*Option—Not for Benefit (W.C.A.)*.—An infant girl had her hand injured, in consequence of which her hand and forearm had to be amputated. She claimed compensation at 2s. 6d per week under the 1897 Act, and afterwards sued at Common Law and recovered £275.

WRIGHT, J.: "I think that if the plaintiff had been a person of full age acting on her own behalf, and knowing what it was the lawyers were doing for her, she might have elected to take compensation under the Act; but having regard to her infancy, it should not be taken into the question."

[*Ford v. Wren and Dunham*, Wright, J., and special jury, 1903, 115 L.T.J., 357; 5 W.C.C., 48.]

*Option: Failure of Common Law Action; Compensation awarded under the W.C.A.; Appeal in Consequence stopped (W.C.A.)*.—An infant, having claimed damages at Common Law and failed, at once applied to have the amount of the compensation assessed under the Workmen's Compensation Act. She then attempted to appeal against the decision of the Judge in the Common Law action, and pleaded that her infancy prevented her from having exercised an option, to her detriment.

Held: "She has made her option, and is estopped from an appeal."

[*Neale v. The Electric Ordnance Company*, 1906, 2 K.B., 358; 8 W.C.C., 6.]

*Failure of Common Law Action—Delay in Exercise of Option to claim under W.C.A. (W.C.A.)*.—An infant workman having failed in a Common Law action against the master, then applied to the County Court Judge for assessment of compensation under the W.C.A. This was more than six months after the date of the accident. The Judge awarded her compensation, but the Court of Appeal reversed the award.

She pleaded that being an infant she was not bound by having exercised an option in a thing that was not for her benefit.

BUCKLEY, L.J.: "The point was taken that the workman in this case was an infant, and *Stevens v. Dudbridge Ironworks Company* (1904, 2 K.B., 225; 6 W.C.C., 48) was cited as an authority for the proposition that the applicant was by reason of infancy not bound by having brought and prosecuted the action. There is nothing in the point. In *Stevens v. Dudbridge Ironworks Company*, the applicant, being an infant, had contracted or purported to contract by a contract which was not for his benefit, and the Court did not apply the ordinary rules in such a case. In the present case the litigation duly commenced in the name of the infant by a next friend was prosecuted to judgment. In such a case an infant is just as much

bound by the proceedings as if he were an adult. If authority be needed, *Neale v. Electric Ordnance and Accessories Company* is authority for the proposition.

[*Cribb v. Kynoch* (No. 2), 1908, 2 K.B., 551; 1 B.W.C.C., 43.]

(iii.) **Compensation for Injury.**—Subject to what is said below with regard to review of payments, an infant suffering from partial incapacity receives compensation on the same basis as that of adults. But total incapacity entitles an infant to receive an amount equal to 100 per cent., instead of 50 per cent., of his average earnings, but that amount of 100 per cent. must not exceed 10s.—W.C.A., 1906, Schedule 1 (1) (b), proviso (b).

(iv.) **Review, Rise of Wages.**—The loss of future prospects in life are considered under the Act in the case of an infant, though not in an adult. “Where the review takes place more than twelve months after the accident, the amount of the weekly payment may be increased to any amount not exceeding 50 per cent. of the weekly sum which the workman would probably have been earning at the date of the review if he had remained uninjured, but not in any case exceeding £1.”—Schedule 1 (16).

(v.) **Payments to Infants.**—These are under two categories: (a) As an injured workman; (b) as a dependant.

(a) *As an Injured Workman.*—In any case, whether the money be due under an agreement or award, it may be ordered to be paid into court, and the Court can then administer the sum.

(b) *Dependants.*—The money payable to an infant dependant is almost always paid into court, and the Court can then deal with it as it thinks fit. Where a mother and her children are awarded a lump sum as dependants in compensation for death, “If on account of neglect of children on the part of a widow, or on account of the variation of the circumstances of the various dependants, or for any other sufficient cause, an order of the Court or an award as to the apportionment amongst the several dependants of any sum paid as compensation, or as to the manner in which any sum payable to any such dependant is to be invested, applied, or otherwise dealt with, ought to be varied, the Court may make such order for the variation of the former order or the award as in the circumstances of the case the Court may think just.”—Schedule 1 (16).

*Posthumous Illegitimate Child may be a Dependant* (W.C.A.).—A miner who had been courting his landlady’s daughter discovered that she was likely shortly to make him a father. He at once agreed to marry her, and the banns were put up; but before the marriage could take place he was killed in the mine.

It was held by the House of Lords that a posthumous illegitimate child was within the scope of the Act.

[*Orrell Colliery Company v. Scholfield* 1909, A.C., 115; 2 B.W.C.C., 294.]

## COLD.

## Insurance.

*Death by Cold not an Accident—Insurance.*—Cockburn, C.J., gave exposure to cold as an illustration of what would not be an accident as follows: "If from the effects of ordinary exposure to the elements, such as is common in the course of navigation, a mariner should catch cold and die, such death would not be accidental, although if, being obliged by shipwreck or other disaster to quit the ship and take to the sea in an open boat, he remained exposed to wet and cold for some time, and death ensued therefrom, the death might properly be held to be the result of an accident. It is true that in one sense disease or death through the direct effect of a known natural cause, such as we have referred to, may be said to be accidental, inasmuch as it is uncertain beforehand whether the effect will ensue in any particular case."

[*Sinclair v. Maritime Passengers' Assurance Company*, 1861, 30 L.J., Q.B., 77.]

NOTE.—Though this was given in 1861 as an instance of what was not an accident, it may be doubted whether, in view of the recent decisions under the Workmen's Compensation Act, this would now be held to be an illustration of what was *not* an accident. In all probability such a death would be a "personal injury by accident," from an "external and visible cause."

## Negligence.

*Frozen Water causes Accident—Negligence not the Natural Consequences of the Tortious Act.*—The defendant washed his van in a public street in breach of the Metropolitan Police Act (2 and 3 Vict., ch. 47, sect. 54). The water ran into the channel and to a grating, which should have conducted it into a drain. Though the defendant did not know it, the drain was frozen up; the water collected, and later became a sheet of ice, upon which the plaintiff's horse slipped and broke its leg.

BOVILL, C.J.: "No doubt one who commits a wrongful act is responsible for the ordinary consequences which are likely to result therefrom; but, generally speaking, he is not liable for damage which is not the natural or ordinary consequence of such an act, unless it be shown that he knows, or has reasonable means of knowing, that consequences not usually resulting from the act are, by reason of some existing cause, likely to intervene so as to occasion damage to a third person. Where there is no reason to expect it, and no knowledge in the person doing the wrongful act that such a state of things exists as to render the damage probable, if injury does result to a third person, it is generally considered that the wrongful act is not the proximate cause of the injury, so as to render the wrongdoer liable to an action. In the present case, the learned Judge has reserved power to us to draw inferences from the facts; and the proper inference to be drawn from the evidence seems to me that, if the drain had not been stopped, and the road had been in a proper state of repair, the water which the defendant's servant

caused to flow into the gutter or channel would have passed away without doing any mischief to anyone. Can it, then, be said to have been the ordinary and probable consequence of the defendant's act that the water should have frozen over so large a portion of the street as to occasion a dangerous nuisance? I think not. There was no distinct evidence to show the cause of the stoppage of the sink or drain, or that the defendant knew it was stopped. He had a right, then, to expect that the water would flow down the gutter to the sewer in the ordinary course; and, but for the stoppage (for which the defendant is not responsible), no damage would have been done. . . ."

GROVE, J.: "I am entirely of the same opinion. I think the act of the defendant was not the ordinary or proximate cause of the damage to the plaintiff's horse, or within the ordinary consequences which the defendant may be presumed to have contemplated, or for which he was responsible. The expression, the 'natural' consequence, which has been used in so many cases, and which I myself have, no doubt, often used, by no means conveys to the mind an adequate notion of what is meant; 'probable' would, perhaps, be a better expression. If, on the present occasion, the water had been allowed to accumulate round the spot where the washing of the van took place, and had there frozen obviously within the sight of the defendant, and the plaintiff's horse had fallen there, I should have been inclined to think that the defendant would have been responsible for the consequences which had resulted. . . ."

KEATING, J.: ". . . I prefer to rest my judgment on the ground that the damage did not immediately flow from the wrongful act of the defendant, nor was such a probable or likely result as to make him responsible for it. The natural consequence, if that be a correct expression, of the wrongful act of the defendant would have been that the water would, under ordinary circumstances, have flowed along the gutter or channel, and so down the grating to the sewer. The stoppage and accumulation of the water was caused by ice or other obstruction at the drain, not shown to have been known to the defendant, and for which he was in no degree responsible. . . ."

"The damage in question, not being one which the defendant could fairly be expected to anticipate as likely to ensue from his act, is, in my judgment, too remote."

[NOTE.—This case is here quoted as an example of damages being not the natural consequences of the wrongful act of the defendant. See *Accident and Accidental Injuries—Defences*, p. 10.]

[*Sharp v. Powell* on appeal, Court of Exchequer, before Bovill, C.J., Grove and Keating, JJ., 1872, L.R. 7, C.P. 253.]

*Frost causes Damage—Negligence.*—The defendants, in connection with their waterworks, had some fire-plugs by the roadside inserted into their water-pipes. They supplied water under statutory powers, but under the statute they were bound to fix such fire-plugs. The statute also enacted that the pipes were to be at least 18 inches below the surface of the soil, and the pipes were laid accordingly. Water was found to have percolated from the pipes into the plaintiff's house, where it had caused damage. It appeared probable that "one of the severest frosts on record" froze the water in the

pipes outside the plaintiff's house, and that the pressure caused by the ice lifted out one of these fire-plugs, and that later on the water escaped, as months after it was found to have percolated into the house, and to have caused the damage complained of.

The case was heard, and the judgment appealed against.

ALDERSON, B.: "I am of opinion that there was no evidence to be left to the jury. The case turns upon the question whether the facts proved show that the defendants were guilty of negligence. Negligence is the omission to do something which a reasonable man, guided upon those considerations which ordinarily regulate the conduct of human affairs, would do, or doing something which a prudent and reasonable man would not do. The defendants might have been liable for negligence if, unintentionally, they omitted to do that which a reasonable person would have done, or did that which a person taking reasonable precautions would not have done. A reasonable man would act with reference to the average circumstances of the temperature in ordinary years. The defendants had provided against such frosts as experience would have led men, acting prudently, to provide against, and they are not guilty of negligence because their precautions proved insufficient against the effects of the extreme severity of the frost of 1855, which penetrated to a greater depth than any which ordinarily occurs south of the polar regions. Such a state of circumstances constitutes a contingency against which no reasonable man can provide. The result was an accident, for which the defendants cannot be held liable."

BRAMWELL, B.: "The Act of Parliament directed the defendants to lay down pipes, with plugs in them, as safety valves, to prevent the bursting of the pipes. The plugs were properly made, and of proper material; but there was an accumulation of ice about this plug, which prevented it from acting properly. The defendants were not bound to keep the plugs clear. It appears to me that the plaintiff was under quite as much obligation to remove the ice and snow which had accumulated as the defendants. However that may be, it appears to me that it would be monstrous to hold the defendants responsible because they did not foresee and prevent an accident, the cause of which was so obscure that it was not discovered until many months after the accident happened."

[*Blyth v. The Birmingham Waterworks*, on appeal before Alderson, Bramwell, B.B., 1856, 11 Ex., 781.]

NOTE.—This case is merely given here as it contains the classic definition of "negligence." See *Accidents and Accidental Injuries*, p. 4.

### Workmen's Compensation Act.

Under the Workmen's Compensation Act, in order that a successful claim may be made on account of a workman who suffered from frostbite or who died from cold, proof will have to be made that his work especially exposed him to cold, there being some analogy between heatstroke, sunstroke, and lightning, which have all been held to be accidents within the Act, but only when there is special exposure to such dangers.

**Frostbite** (W.C.A., County Court).—In a case where frostbite was admitted by the employer to be an accident, Judge Willis, when

informed that the applicant, a seaman, "while adrift on the River Scheldt, got his fingers frostbitten," said, "I do not think this was an accident; a sunstroke might be."

[*Stricer v. Owners of the schooner Winifred, Greenwich C.C., Judge Willis, K.C. Standard, May 22, 1909.*]

**Frostbite** (W.C.A., County Court).—The applicant stated that on December 29, 1908, he was engaged in clearing the snow away in the streets of Kensington. His duty included distributing salt upon the roads. After sixteen hours' work he went to the depot and drew 8s., then proceeded straight home. He was wearing at the time thick socks and strong boots; but he felt pain in both feet, and the next day the pain was intensified. He consulted a doctor, who informed him that he was suffering from frostbite. He went to St. George's Hospital, and subsequently to a convalescent home.

Dr. J. Gatteridge said that the plaintiff came to him suffering from gangrene, and he came to the conclusion that this condition arose through working in the snow mixed with salt. Such a mixture produced intense artificial cold. He had no doubt that the condition of the man's feet was caused by this freezing mixture. Dr. Bernard Day, of St. George's Hospital, supported this view.

The applicant submitted that the occurrence which gave rise to his injury] was unintended and unexpected and produced loss, and therefore came within the meaning of the Act.

His Honour decided that the case was one which did come within the meaning of the Act, and he made an order for the applicant to receive 11s. a week from December 31, 1908.

[*Holleron v. Kensington Borough Council, Marylebone C.C. Standard, April 24, 1909.*]

## DEATH.

### Insurance.

As one of the consequences of accident, Death is a subject dealt with on pp. 13-17. Many cases of death which have been made the subjects of claims under insurance policies will be found quoted under the various title-heads of the Case Guide—*e.g.*, Lungs (Pneumonia), Infection (Erysipelas and Blood-poisoning). Suicide cases will be found under the heading of Insanity. The presumption of law is against suicide, as it is a crime, so that when the tribunal of fact find that the evidence as between accident and suicide is equally balanced, the presumption of law, being against crime, will be against suicide (*Harvey v. The Ocean Accident Company, L.R. Ir., 1905, 2 K.B., 1*). For further notes on suicide, see Insanity.

*External and Visible Means (Insurance, American).*—Words of the policy: "Against bodily injuries, sustained through external, violent, and accidental means, if death results from such injuries within ninety days therefrom, independently of all other causes."

The insured left home after breakfast, returned about ten o'clock, telling his servant he did not feel well, that he was dizzy, and was going

to lie down. The servant brought him a cup of tea, helped him to carry a gas-stove into his room. He was never again seen alive.

At twelve o'clock his wife found him dead on the floor, which was polished hard wood recently damped; his head was on the fender, and a displaced rug at his feet.

The medical evidence: General good health, blood on the fender, blood round his nose, bruise at base of neck; some doctors said death was caused by a fall and concussion of the brain.

Held: There was evidence enough to justify a jury in finding death was due to "external, violent, and accidental means," and not from vertigo, from which there was no evidence the deceased had ever suffered.

[*Larkin v. Interstate Casualty Company*, Supreme Court of New York, Goodrich, P. J., N.Y., 43, App. Div., 365.]

*Drowning* (Insurance).—Words of policy: ". . . sustain any injury caused by accident or violence within the meaning of that policy, and should die . . . provided that no claim should be made in respect of any injury unless the same should be caused by some outward and visible means."

Insured's clothes were found on the steps of a bathing-machine, and six weeks afterwards a body was washed ashore which was identified as his, though the jury found it was that of an unknown."

COCKBURN, C.J.: "If there was evidence for the jury that the deceased died by drowning, that was a death by accident within the policy."

[*Trew v. Railway Passengers' Association*, 6 H. and N., 839; 30 L.J.Ex., 671 (Ex. Ch.).]

### Insurable Interest.

The Gambling Act, 1774, 14 George III., cap. 48, sect. 1, enacts "that no insurance shall be made on lives, or any other event, wherein the person for whose benefit the policy shall be made shall have no interest, and that every such assurance shall be void."

In addition to the interest a creditor has in a debtor's life, even a husband and wife have each an insurable interest in the other's life.

LORD KENYON: "It must be presumed that every wife has an interest in the life of her husband" (*Reed v. Royal Exchange Assurance Company*, Peake, Add. Cas., 70).

KENNEDY, L.J.: "The ruling of Lord Kenyon a century ago in favour of the wife's claim ought now to be applied in favour of the husband's" (*Griffiths v. Fleming*, 1909, 2 K.B., at p. 821).

A parent cannot make a valid insurance on his child's life unless he has a pecuniary interest in the life (*Halford v. Rymer*, 1830, 10 B. and C., 724).

It is submitted that in the same way a son cannot insure his father's life after the father has ceased to be liable to support his son.

### Negligence.

Attempts have been made to make claims for the pain and suffering to the survivors; for loss of services caused by death; for the



pain and losses sustained by the deceased man ; and to substitute as plaintiff the wife for the deceased man after his death in an action commenced during the lifetime of her husband. For the legal position illustrated by these cases, see above, Consequences of Accident, p. 14.

*No Right of Action in the Deceased had he Survived ; none in his Representatives.*—A man was exercising a horse in the public street ; this was not negligence, but was a breach of a statute. The horse killed a passer-by, whose relatives sued for the damages caused by the death. It was held the survivors had no right of action, as the deceased, had he lived, would have had none (*Roe v. Lalouette*, 1858, 9 Ir.C.L.R., 9).

*Action barred against the Deceased in his Lifetime is also barred against the Claim by Relatives under the Fatal Accidents Act.*—The plaintiff's husband was injured in December, 1902, by falling into a lock through the negligence of the defendants. He lived till December, 1904, when he died, and in February, 1905, his wife brought an action under Lord Campbell's Act.

It was held that, as her husband was barred by the Public Authorities Protection Act from bringing an action after six months had elapsed, she also was barred.

MATHEW, L.J. : " In this case no action was brought by the deceased man in respect of his injuries, and the present action is brought by his widow after the lapse of a period much longer than six months after the act, neglect, or default, complained of in the action. It appears to me clear, having regard to the provisions of the Public Authorities Protection Act, 1893, that the action is not maintainable."

COZENS-HARDY, L.J. : " In the present case the deceased could not, at the date of his death, or at any time after a lapse of six months from his injury, have maintained an action in respect of that injury against the defendants ; and therefore his representative cannot maintain this action."

[*Williams v. Mersey Docks and Harbour Board*, 1905, 1 K.B. (C.A.), 804.]

### Sudden Death.

*Death of Husband ; Claim for Damages—Mental Suffering cannot be included in estimating Damages.*—The plaintiff's husband, who was earning about £500 a year, was killed on the Midland Railway. The wife claimed under Lord Campbell's Act for damages for her financial loss and for mental suffering and loss of society.

COLERIDGE, J. : " The measure of damage is not the loss or suffering of the deceased, but the injury, resulting from the death, to the family."

Held : " That she can only recover her financial loss."

[*Blake v. The Midland Railway Company* (on appeal), 1852, 18 Q.B., 93.]

*Sudden Death of Wife ; Loss of Services by Illness and by Death—Negligence.*—The plaintiff, who was a publican, was a passenger

with his wife on the top of a stage-coach travelling from Portsmouth to London. The coach overturned, and the two were thrown to the ground, the plaintiff being badly bruised, but the wife so seriously injured that she died a month after. His wife had always been a great help to the plaintiff in his business. He sued the defendants, the owners of the coach, for damages, claiming for his own bruises and for the injury he sustained, as he had by their negligence "lost and been deprived of the comfort, fellowship, and assistance, of his said wife, and had from thence hitherto suffered and undergone great grief, vexation, and anguish of mind."

LORD ELLENBOROUGH: "The jury could only take into consideration the bruises which he had himself sustained and the loss of his wife's society, and distress of mind, from the time of the accident till the moment of her dissolution. In a civil court the death of a human being could not be complained of as an injury; and in this case the damages, as to the plaintiff's wife, must stop with her existence."

He was awarded damages of £100.

[*Baker v. Bolton*, 1 Camp., 493.]

NOTE.—This was not an action under Lord Campbell's Act, but at Common Law. There was some doubt as to whether this was an action in contract or tort, but in giving his judgment in *Jackson v. Watson and Sons* (1909, 2 K.B., at p. 202), Farwell, L.J., stated "it was an action in tort."

*Sudden Death of Daughter; Funeral Expenses; Loss of Services—Negligence* (Lord Campbell's Act and Common Law).—The plaintiff and his daughter were riding bicycles, when the defendants' omnibus collided with and killed the daughter. The plaintiff claimed under Lord Campbell's Act and at Common Law the funeral expenses to which he had been put, the travelling expenses incurred to recruit the health of himself and his wife, they having become ill by reason of the shock occasioned by their daughter's death, and the loss sustained by the plaintiff owing to the loss of the services of his wife and daughter.

The jury found that the company had been negligent, and that their negligence caused the death, and that the shock of the death made the father and mother ill, and that the damages caused by the negligence amounted to £20, and that the funeral expenses amounted to £14, but that the plaintiff suffered no damages by the loss of the services of the deceased.

DARLING, J., held that the plaintiff was not entitled to recover £20 damages for the illness of the plaintiff and his wife caused by the shock, but gave judgment for the rest of the damages. The defendants appealed against the £14 for funeral expenses, but as the right to claim this appears to have been based on the relationship of master and servant, the law of "loss of services" due to immediate death was discussed in the Court of Appeal.

GORELL BARNES, J.: "There is an explanation given in the judgment of Gwynne, J., in *Monahan v. Horne* (7 Canada Sup. Ct. R., 409), of a reasonable difference between an action brought for loss of service where the service has been suspended by injury, and an action brought where there has been an absolute termination of

the services by death. That judgment appears to me to give a very satisfactory reason for the difference between the two positions—namely, where there is a claim for loss of service, and the contract of service still continues, and, on the other hand, where no claim can be sustained in consequence of the contract absolutely coming to an end by the death of the servant.”

Held: “The plaintiff was not entitled to recover damages for the loss of services or for the shock, either at Common Law or under Lord Campbell’s Act, nor could the funeral expenses be recovered.”

[*Clark v. London General Omnibus Company*, 1906, 2 K.B. (C.A.), 648, from *Darling, J.*, and common jury (on appeal).]

*Death of Infant Son—Some Loss, however small, must be proved.*—The deceased, the son of the plaintiff, an infant aged fourteen, was killed by the falling of the defendant’s wall. He had earned four shillings weekly, which was applied by his father to the common maintenance fund of the family. No evidence was given as to whether the sum earned exceeded or was less than his actual cost of maintenance. The jury found a verdict for the plaintiff, damages £20, giving £10 to the father and £10 to the mother.

An appeal was made to enter judgment for the defendant, or to reduce the damages to a nominal sum, on the ground that no such loss or damage was shown to have resulted from the death of the deceased as entitled the plaintiff to maintain the action, or to recover more than nominal damages if the action lay.

POLLOCK, C.B.: “There was no distinct evidence with respect to the actual expense which the father would be at in maintaining and clothing the boy, and I think probably it was a question upon which the jury were much better judges than we could be. . . . I own my impression is, looking at the Act of Parliament, that if there was no damage the action is not maintainable. . . . Apart from any questions of affliction or family comfort, and of that pleasure which the father would take in the prospects of a boy who was said to be of lively parts and considerable industry and activity, it is exceedingly likely, as a matter of profit and loss, that the father would not have taken £20 for the services of his son. . . . It having been decided that, where there is the prospect of benefit to the parent or executor, the jury may take that into consideration, it is probable they would do so with regard to a boy in the condition in which this boy was, and in reference to what he had done during the last two years.”

[*Duckworth v. Johnson*, 1859, 29 L.J.Ex., 25.]

*Expectation of Benefit—Negligence.*—The plaintiff was an old and infirm man who had had a light job for thirty-two years, and for which he was paid 3s. 6d. a week.

He had a son earning good wages, who, in addition to his regular work, had, for some time, done the work for which his father was paid; the father was infirm and too ill to do it.

The son was killed in a railway accident, and the father claimed damages. The defence was that no actual loss was sustained. The jury awarded £75 damages, which was considered to be excessive by the Exchequer Chamber, but they upheld the judgment.

POLLOCK, C.B.: "The plaintiff was old, and getting infirm; the son was young, earning good wages, and apparently well disposed to assist his father; in fact, he had so assisted him to the value of 3s. 6d. a week. We do not say that it was necessary that actual benefit should have been derived, a reasonable expectation is enough, and such reasonable expectation might well exist, though from the father not being in need, the son had never done anything for him. On the other hand, the jury certainly ought not to make a guess in the matter, but ought to be satisfied that there had been a loss of sensible and appreciable pecuniary benefit, which might have been reasonably expected from the continuance of the life."

[Franklin *v.* South-Eastern Railway, on appeal from order of Bramwell, B., 1858, 3 H. and N., 211.]

*Sudden Death—Reasonable Expectation of Pecuniary Benefit—Negligence.*—The action was brought by the widow and administratrix of a gentleman of the name of Pym, who had lost his life by an accident on the defendants' railway, occasioned by the negligence of their servants. The deceased was a tenant for life of a settled estate in land, the value of which was a little short of £4,000 a year. By the provisions of the settlement, a jointure of £1,000 a year was settled on his wife, and a sum of £20,000 was secured to the younger children on his death. The estate itself passed under the entail to his eldest son.

The action was brought by the widow under the Fatal Accidents Act on her own behalf and that of her younger children to recover compensation for the pecuniary loss sustained by them in consequence of his death. The heads of loss mainly relied on by the plaintiffs were—first, the loss of the advantages of superior education, and of the social position and personal comfort of which the father's income, had he lived, would have secured the benefit and enjoyment to the family; secondly, the loss of that provision which it was to be presumed that the deceased, as a prudent father of a family, would have made by saving from his income for the benefit of his wife and younger children.

It was objected that the case does not come within the statute, and that the loss, even if a pecuniary loss at all, is too uncertain and too remote.

The Court upheld the judgment of Cockburn, C.J., in the court below, but reduced the damages awarded from £13,000 to £9,000.

COCKBURN, C.J.: "It is true it must always remain matter of uncertainty whether the deceased person would have applied the necessary portion of income in securing to his family the social and domestic advantages of which they are said to have been deprived by his death; still more, whether he would have laid by and what proportion of his income to make provision for them at his death. But, as it has been established by the cases decided upon the statute, that if there be a reasonable expectation of pecuniary advantage, the extinction of such expectation by negligence, occasioning the death of the party from whom it arose, will sustain the action. It is for the jury to say, under all the circumstances, and taking into account all the uncertainties of the particular case, whether there was such a reasonable and well-founded expectation of pecuniary benefit

as can be estimated in money, and so become the subject of damages in such an action."

[*Pym v. The Great Northern Railway*, 1862 (on appeal), before Cockburn, C.J., Blackburn, Crompton, and Mellor, JJ., 31 L.J.; Q.B. 249.]

**Death after an Interval of Time.**—In an action for negligence a claim for damages cannot be made by the survivors for the personal injuries inflicted on the deceased during his lifetime, but it may be made for the damages they themselves have suffered during his lifetime—*e.g.*, by loss of his services, etc.

*Writ during Life; Wife substituted as Plaintiff after her Husband's Death—Actio Personalis Moritur cum Persona.*—Edward Pulling was crossing the defendants' railway by a level-crossing, when he was knocked down and injured by a passing train. He commenced action for damages caused by the defendants' negligence; he claimed for loss of business and for medical and nursing expenses. At the time of his death his estate had been diminished by these expenses. He died before judgment was given.

It was held that his wife could not maintain his action by being substituted in place of the deceased.

DENMAN, J. "I do not think we can hold this action maintainable without in practice entirely abrogating the doctrine of law expressed in the maxim, *Actio personalis moritur cum persona*. To a certain extent that doctrine has been qualified. Under the statute of Edward III., it has in many cases been held that where the cause of action, whatever its form may be, is in respect of a tortious impairment of the personal estate, such action may be maintained by the personal representative. But none of the authorities go so far as to say that, where the cause of action is in substance an injury to the person, the personal representative can maintain an action merely because the person so injured incurred in his lifetime some expenditure of money in consequence of the personal injury. The case of *Bradshaw v. The Lancashire and Yorkshire Railway* certainly does not go that length, because the judgments in that case are expressly based upon the distinction in this respect between actions of contract and actions of tort, and upon the fact that in that case the action was an action of contract."

[*Pulling v. Great Eastern Railway*, 1882 (on appeal), 9 Q.B.D., 110.]

*Loss of Services and Companionship of Wife.*—See above, p. 916, *Baker v. Bolton*, where the plaintiff was allowed damages "from the time of the accident till the moment of her dissolution," which damages "must stop with her existence."

*Loss of Companionship—of Wife (per quod consortium amisit)*—see above, *Baker v. Bolton*.—When the husband loses the companionship of his wife by the wrongful act of a third party, in an action for negligence he can claim for that loss, if she be living, and up to the time of her death if she die after an interval of time.

*Loss of Companionship (of Husband).*—We have not been able to find any case of a successful claim for damages sustained by the wife by the deprivation of her husband's companionship.

In an unsuccessful action for defamation, special damages were claimed by the wife for loss of *consortium* of her husband, and the judges disagreed as to whether such an action could be maintained.

LORD WENSLEYDALE held that such a loss would not sustain an action, but the following judgment was given in favour of her claim in this respect.

LORD BROUGHAM: "Although this is a case of first impression, if it can be shown that there is presented to us a concurrence of loss and injury from the act complained of, we are bound to say that this action lies. Nor can I allow that the loss of *consortium*, or conjugal society, can give a cause of action to the husband alone. . . . The loss of conjugal society is not a pecuniary loss, and I think it may be a loss the law might recognize to the wife as well as to the husband."

[*Lynch v. Knight*, 1861, 9 H.L. Cases, 577, 589.]

### Contract.

For the legal position of the parties under these cases, see above, Consequences of Accident: Death—Contract, p. 16; they depend upon whether:—

1. Both parties to the contract survive, but owing to the breach of it, by one party, a death follows, which causes damage to the other party; or,

2. One party dies, and the personal representative sues for the damages sustained by the deceased man before his death.

(a) **Sudden Death**\*—*Loss of Wife's Services in the Future; Contract with Husband; Implied Warranty (Sale of Goods Act); Measure of Damages is the Loss of the Wife's Services.*—The plaintiff's wife died from eating tinned salmon supplied to him by the defendants, who were provision-dealers. He claimed damages for the breach of an implied warranty of the fitness of salmon for food. His damages were based on the expenses of medical attendance to his wife, the funeral expenses, and the loss of his wife's services to him, and on the ground that "after her death he had to have someone in to replace her services."

The jury found for the plaintiff for medical and funeral expenses, which were not questioned, but the defendants disputed the £200 for the loss of services "in future." The Court of Appeal upheld the judgment.

VAUGHAN WILLIAMS, L.J.: "When the plaintiff sues in contract, the cause of action in such a case arises on the breach, and damages ensue as a matter of course, although the amount may be only forty shillings. The plaintiff is the contractor, and the person killed a third person. In such a case I see no ground for applying the ruling in cases of tort; the death is not an essential part of the cause of action, but it is only an element in ascertaining the amount of damages, and I know of no authority, and can find no ground in reason or common sense, why no damages should ever be given in case and by reason of death.

"The plaintiff here has a cause of action in contract; and if the

\* This is strictly not a case of sudden death, but the claim was partly made for damages caused by the death.

breach of a contract occasions pecuniary damage, necessarily or naturally flowing from the breach, it appears to me that, as a matter of principle, such damage ought to be recoverable equally where it is connected with the death or with the bodily injury of the person the loss of whose services, through the breach of contract, constitutes the plaintiff's claim. The plaintiff in such a case does not found his action on the death of his wife or servant, as the case may be; he has, in the defendant's breach of contract with himself, a right of action wholly independent of the killing of the deceased *per se*."

Held: "The death of the plaintiff's wife not forming an essential part of the cause of action sued upon, but only an element in ascertaining the damages arising therefrom, there was no rule of law which prevented such damages as aforesaid from being recoverable in the action."

[*Jackson v. Watson and Sons* (on appeal), 1909, 2 K.B., 193.]

(b) **Death after an Interval of Time.**—"If a man contracted for a safe conveyance by a coach, and sustained an injury by a fall, by which his means of improving his personal property was destroyed, and that property was in consequence injured, though it was clear that he in his lifetime might at his election sue the coach-proprietor in contract or in tort, it could not be doubted that his executor might sue *in assumpsit* for the consequence of the coach-proprietor's breach of contract (*Knights v. Quarles*, 12a, 18, No. 2, Brod. and B., 104).

*Illness preceding Death caused by Railway Accident ; Damages caused to Deceased during his Life.*—Mr. Bradshaw, a railway passenger, was injured when travelling on the train of a railway company, who were presumed to have contracted to take due care in carrying him while he was such a passenger. After an illness of some duration he died, and his wife sued for damages. The damages were not claimed for losses caused by death, but for those incurred for the illness during the period preceding his death, and included £40 for medical fees and £150 for loss of business.

Held: "The plaintiff can recover, as it was an action for *contract*, not tort."

[*Bradshaw v. Lancashire and Yorkshire Railway*, L.R., 1873, 10 C.P., 189.]

*Death of Wife ; Damages in Respect of Loss and Expense to which the Plaintiff had been put by the Illness and Death of his Wife ; Contract with Husband (Sale of Goods Act).*—The plaintiff purchased milk for the consumption of his wife and family. The milk contained germs. The wife died of typhoid caught from the milk, and the plaintiff claimed damages up to date of his wife's death. It was held by the jury that the plaintiff relied on the seller's skill and judgment, and in so relying suffered the damages claimed. He was awarded damages, and the judgment was upheld by the Court of Appeal. It does not appear, from the report in the Court of Appeal, that any claim was here made for loss of services, but only for the damages as mentioned above.

[*Frost v. Aylesbury Dairy Company*, 1905, 1 K.B. (C.A.), 608.]

### Workmen's Compensation.

There is nothing payable except for the loss of the breadwinner—nothing for pain or suffering of the survivors. The amount is limited to the maximum allowed under the Act. See above, Consequences of Accident—Workmen's Compensation Act, p. 16.

### Accident Cause of Death.

When the evidence of accident is clear, the award of the arbitrator is final as to the cause of death.

*Cause of Death, whether due to Accident or not* (W.C.A., Scottish).—A stone fell on a man's foot on May 4th; after intervals of ill-health and work, he eventually died of apoplexy on June 29. The arbitrator held the death was not due to the accident. The dependant appealed and the Court dismissed the appeal.

LORD JUSTICE CLERK: "The question whether the death resulted from or was accelerated by an accident is a pure question of fact."

(This case is more fully described under Brain—Vessels of the Brain, p. 897.)

[Warnock *v.* Glasgow Iron Company, 1904, 6 F., 474; 41 S.L.R., 359.]

*Fall from Driver's Seat on an Omnibus* (W.C.A.).—A bus-driver was sitting on the box of his bus; a thud was heard, and he was found to have fallen from it. There was no evidence as to how it happened. Conflicting medical evidence as to the cause of death was given, but as to the state of the man's heart it was agreed it was abnormal, and the County Court Judge stated that on the evidence he believed that the man had died from heart failure and not from the fall, and that the applicant, therefore, had not discharged the onus of proving that the cause of death was a personal injury by accident arising out of and in the course of the deceased's employment.

The Judge found that there was no evidence that there was any accident. The dependants appealed, but the Court refused to allow the appeal.

[Thackway *v.* Connelly, Hereford C.C., Judge Harris Lea; 3 B.W.C.C., 37.]

### Arising out of and in the Course of the Employment.

In many cases where a workman has been found dead, actual proof of the circumstances under which he was killed is impossible. The arbitrator then can act as a jury, and if there is some evidence upon which he can draw an inference as to how the death occurred, he can then draw that inference. The following cases are grouped into two classes: (1) Where it was held that the arbitrator could draw an inference that death was caused by an accident "arising out of and in the course of the employment," and (2) where it was held he could not draw such an inference.



*Inference drawn that Death did "arise out of and in the Course of the Employment."*

*Unexplained Injury to Workman; Death.*—A repairer in a colliery left home to go to his work, uninjured, and returned with a crushed thumb after finishing his work. He died in sixteen days from blood-poisoning. There was no evidence available upon which the Court could decide as to how the thumb was injured.

Held: "The County Court Judge could draw an inference that the accident would be more likely to happen at the work upon which the deceased had been employed than elsewhere. In consequence he could hold that the injury arose out of and in the course of the employment."

[*Mitchell v. Glamorgan Coal Company*, 1907, 23 T.L.R., 588; 9 W.C.C., 16.]

*Unexplained Accident causing Death.*—A railway policeman was under a duty to take cash-boxes to and from a bank, and also to act as a policeman on the line for the rest of the time. He had taken some money to the bank one day, was seen returning towards his duties, and was next discovered, dead, run over by an engine.

Held: "There was evidence that the accident arose out of and in the course of the employment."

LORD ARDWELL: "A railway policeman's duties are to go anywhere about a station. . . . It might be absolutely impossible in many cases for those claiming on the death of a railway policeman to tell what was in his mind in being at a particular place. He would keep that to himself."

Held: "The accident arose out of and in the course of the employment."

[*Grant v. Glasgow and South-Western Railway Company*, 1908, 45 S.L.R., 128; 1 B.W.C.C., 17.]

*Special Exposure; Seaman on Watch—Obiter Dictum (Fletcher Moulton, L.J.).*—"If on a stormy night one of the watch of a ship was found to be missing, the inference to be drawn would be that the most natural cause of the accident was the increased danger to which the seaman was subjected 'in the course of' his employment, and that therefore the accident arose 'out of' his employment."

[*Bender v. Owners of the s.s. Zent*, 1909, 2 K.B., 41; 2 B.W.C.C., 22.]

*Unexplained Death at Sea; Officer on Duty (W.C.A.).*—On the morning of June 30, 1909, Rice was in charge of the vessel during the second watch from 4 a.m. to 8 a.m., the weather being quite fine. It was his duty to be on the bridge or on some other part of the deck, where he might be required. During the early part of the watch he went down to the captain's cabin, saying he had a headache and felt giddy and was "heaving." He was given a dose of castor oil, and went back to his watch on deck and set the men to work. He was seen on deck up till 7 a.m. No one saw him fall overboard, but between 7 and 8 a.m. he was missed. The captain came on deck at 8 a.m., and after his breakfast he instituted a search throughout the ship. Rice was never seen again. The rail at the side of

the ship was 2 feet 2 inches high. There were three other men on deck during the watch besides Rice. It was suggested that Rice had left the bridge to examine the lifeboats, but there was no evidence of this. Rice's dependants applied for compensation, and the County Court Judge held that the case was distinguishable from those of *Bender v. Owners of the steamship Zent*, 1909, 2 K.B., 41 2 B.W.C.C., 22; and *Marshall v. Owners of the Ship Wild Rose*, 2 B.W.C.C., 76, and he held that as Rice was the officer in charge of the watch on deck at the time of the accident, it arose out of as well as in the course of his employment.

The employers appealed.

COZENS-HARDY, M.R. : "It may be that no human being saw the accident, but if the fact be that, taking one's ordinary knowledge of the world, it is much more probable that the accident arose out of his duty or employment than not out of his duty, the Court is justified in drawing that inference. The best instance, the one which is always referred to in support of that proposition, is *Michell v. The Glamorgan Coal Company, Limited* [see above]. Here there is a peculiar feature which arises, so far as I am aware, for the first time. At the time when this man disappeared he was the officer in charge during the watch. The watch began at four o'clock in the morning. He was told off by the captain, who left him in charge. There were two or three other men who were also on watch, but he was undoubtedly the officer in charge, responsible for everything which was going on on board ship, and to be on the lookout to see that everything went right. His sphere of duty was the deck, the upper part of the vessel; and that being so, I think we are entitled to say this, that the accident arose from his being in a part of the vessel where the accident was most likely to arise; that his duties brought him into this special position of danger. Although it is impossible for us to say that it was in the discharge of any one particular duty that the accident took place, and, although it is impossible for us to say what was the particular fact which may have called him to a particular part of the vessel or of the rigging during that early hour of the morning, I think we are entitled to ask ourselves this: A man being there in the course of his duty, in the discharge of his duty, in a place where he was exposed to a danger, is it, or is it not, more likely that the accident arose out of his employment than that it arose from larking or from any other cause we can suggest? In my opinion, this is a case in which we are justified as men of the world, and as knowing what really goes on on vessels of this kind, in inferring, as the learned County Court Judge did, that the accident arose not only in the course of the employment, but out of the employment."

BUCKLEY, L.J., delivered a dissentient judgment.

[*Rice and Another v. Owners of Swansea Vale*, 3 B.W.C., 152.]

*Engineer last seen sleeping in Bunk; an Hour after found drowned.*—An engineer who was employed on board a small steam-tug was last seen asleep in his bunk at 5 a.m. An hour afterwards he had disappeared, leaving his working clothes lying at the side of his bunk. The tug was to commence towing at 7 a.m. that morning, and steam had been ordered to be got up for that hour. The deck was

a place where between 5 and 7 a.m. he was entitled to be. Two days afterwards his body, clad in his ordinary sleeping clothes, was found in the water near the place where the tug had been moored on the morning in question. In the opinion of the doctor who examined the body, death was due to drowning. There was no direct evidence as to how the deceased, who was unable to swim, had met with his death.

Held: "The arbiter was entitled to draw the inference of the fact that the workman had accidentally fallen overboard and been drowned, and that the accident arose out of and in the course of his employment."

[*Mackinnon v. Miller*, 46 S.L.R., 299; 2 B.W.C.C., 63.]

*Death* (W.C.A.).—A steward of a steamship which was discharging cargo returned on board by the cargo-shoot, a method which was used by the men; but though this was not right conduct, yet there was no proof of any rule or regulation forbidding him to do so. In stepping from the skid to the deck he stumbled into the unguarded hatch, and fell into the hold.

COZENS-HARDY, M.R.: "The deceased went on shore, and was at liberty to return to the ship at any time before six o'clock in the morning. It seems to me that it was in the course of the employment of the deceased that the accident occurred."

[*Robertson v. Allan Brothers and Co.*, 1908, 98 L.T.R., 821; 1. B.W.C.C., 172.]

*No Inference drawn that Death arose out of and in the Course of the Employment.*

*Seaman returning from Shore; Unexplained Absence; Death.*—Thomas McDonald, donkeyman, whilst returning on board ship from the shore, more or less the worse for liquor, refused the aid of night watchman and policeman to assist him up the gangway, and on reaching the top step suddenly overbalanced and fell over the gangway mainropes, dropping between the ship and quay, and striking the iron girder before reaching the water.

COZENS-HARDY, M.R.: "Nothing more has been proved than that the man fell on his way back to the ship. It does not appear (1) whether he had gone ashore on ship's business, or (2) whether he went on shore on a spree without leave, or (3) whether he had leave to go ashore. In this case, as in all similar cases, it is for the applicant to prove affirmatively that the accident arose out of and in the course of the employment. . . . If he was sent ashore on a ship's errand, he would be within the Act. If he went on shore without leave, he would plainly not be within the Act. If he went on shore not on a ship's errand, but with leave for his own pleasure, I think he would equally not be within the Act. To give an illustration which possibly appeals to most of us: If I send my domestic servant in the evening with a letter to a friend, and he is knocked down by a motor-bus on his way to or from my friend's house, I should be liable. If, however, he, having a night off, goes—as he is at full liberty to go—to the Franco-British Exhibition for his own

amusement, and meets with an accident at the same spot, I take it that I should not be liable."

Held: "No proof that the accident arose out of and in the course of the employment."

[Macdonald *v.* Owners of s.s. *Banana*, 1909, 1 K.B., 417; 1 B.W.C.C., 185.]

*Unexplained Death at Sea.*—While a ship was on the high seas the cook fell overboard and was drowned. The weather was perfectly calm at the time; it was daylight, and the ship was steady. There was no evidence to show how the deceased had fallen overboard. A claim for compensation under the Workmen's Compensation Act, 1906, was made by a dependant of the deceased.

COZENS-HARDY, M.R.: "There are many contingencies, any one of which is almost as probable as the other. Although the deceased was chief cook and baker, it is conceivable that he might have been engaged on some ship's work, or something incident to his presence on deck at that early hour. It is conceivable that he may have been out there amusing himself, or, to use the word which has been frequently used in cases of this class, 'larking.'"

Held: "The dependant had failed to discharge the onus upon her of proving that the accident arose 'out of and in the course of the employment' of the deceased, there being no justification for inferring that the accident arose 'out of' the employment, because it was admitted that it happened 'in the course of' it."

[Bender *v.* Owners of s.s. *Zent*, 1909, 2 K.B., 41; 2 B.W.C.C., 22.]

*Unexplained Death at Sea.*—Marshall, the deceased man, was second engineer on board the *Wild Rose*, which was lying at a wharf in a tidal basin in Aberdeen Harbour. From the evidence of the first engineer, it appeared that he and the deceased had been on shore that evening, and had returned about ten o'clock. Steam was to be got up by midnight. They went down to their berths, and Marshall took his clothes off, except his trousers, shirt, and socks. It was a very hot night, and Marshall got up and said he would go for a breath of fresh air. He went on deck. When the first engineer went on deck about twelve o'clock, Marshall was missing, and the next day his body was found in the water close to the ship, and just under the place where the men usually sat.

COZENS-HARDY, M.R.: "We are asked to infer . . . these two propositions: first, that the man went on deck not merely to take fresh air, as he was entitled to do, but in order to enable him to discharge better the duty to get up steam, which was then imminent; and, secondly, that it was in the performance of that duty that he sat on the starboard quarter, leaned against the board, and fell over backwards. With some regret, I am unable to think that such an inference can be justified."

Held: "No proof that the accident arose out of and in the course of the work."

[Marshall *v.* Owners of ship *Wild Rose*, 1909, 2 K.B., 46; 2 B.W.C.C., 76.]

*Unexplained Death.*—A craneman in a locomotive works in charge of two overhead cranes in one of two neighbouring bays was found

dead in the other bay. His employment was intermittent. The arbiter found that the deceased had no right whatever to be there, unless he had been called across by the night foreman for something special, or unless there were no other craneman on duty; that no evidence had been adduced of any request having been made by the night foreman, that official not having been called as a witness, and that the other craneman was on duty.

LORD M'LAREN: "We do not know what motive led Miller to undertake that unfortunate and perilous visit to the upper part of the crane, but it is quite evident from the findings that it had nothing to do with the employers' business. His duty was to remain at his post until he got a signal to work the crane, though if he left it for an innocent purpose, and took no risk, a Court of law might come to the conclusion that an accident happening to him arose out of his employment. But the facts here show that Miller by climbing on to the crane did expose himself to serious and unnecessary risk."

Held: "Not proved that the accident was one arising out of and in the course of the employment."

[*Millers v. The North British Locomotive Company, Ltd.*, 1909, 46 S.L.R., 755; 2 B.W.C.C., 80.]

See also above, p. 868, *O'Brien v. The Star Line, Ltd.*

### Medical Fees and Funeral Expenses.

Cases on these are all grouped together below under the head of Medical Men (pp. 1011-1014).

## EAR.

### Deafness: Legal Position of Deaf Man.

The position of persons under physical disabilities is so well put by Mr. Beven, that we quote him here:

"While deafness or blindness or any similar infirmity does not put the sufferer under civil disabilities, neither does it confer greater rights unless the existence of it is known to the injuring person. If, however, he comes to the knowledge that the person in front of him is deaf or blind or lame, he must regulate his conduct accordingly. Knowledge engenders a greater duty. Till there is knowledge or means of knowledge of infirmity he is justified in carrying on the course of conduct he would be entitled to adopt on the assumption that the person in front of him is normally constituted."

[Beven, "Negligence in Law," third edition, 1908, vol. i., p. 160.]

The spread of inflammation to the brain after an injury to the ear has already been mentioned under Brain. Dr. Barwell points out that a drum perforated in consequence of disease is not only very common, but is a condition indistinguishable from the perforation caused by an accident, when the accident has happened more than a week before the aurist examines the ear.

Ear disease, and sometimes even blocking of the ear, may cause vertigo and a fall, with injury in consequence.

If a fall is caused by such ear disease, this may or may not modify the legal position, if a claim is made under the Workmen's Com-

pensation Act, but it must always be distinguished from a fall without disease.

In connection with the Workmen's Compensation Act, loss of hearing in many instances does not affect wage-earning capacity. In certain noisy trades the majority of the workers are deaf—*e.g.*, boiler-makers.

### Deaf-Mutes.

Congenital deafness, by preventing the infant from hearing, renders it incapable of learning to speak, so that mutism follows. Absence of communication and instruction retard the development of the brain. Such children are often congenital idiots, but may be capable of improvement by learning.

An interesting case of deaf-mutism and its relation to crime will be found in *Rex v. The Governor of H.M. Prison, Stafford*, 1909, 2 K.B., 81; 100 L.T., 993.

**Ear Symptoms.**—For a claim of permanent symptoms connected with hearing, see above, Caisson Disease, p. 900.

In a large number of cases of alleged deafness due to injury wax is present in the ear, and causes the loss of hearing. A doctor giving evidence for an injured workman in such a case described the effects of an alleged injury to an ear-drum, which, in fact, he could not see as it was concealed by wax.

## ELECTRICITY.

Electrical injuries are of three kinds, *viz.*, those caused by—

1. Industrial electricity.
2. Lightning.
3. Medically-applied electricity.

### 1. Injuries from Industrial Electricity.

*Shock, Electric Tramway; Traumatic Neurasthenia (Damages).*—An electric shock was received by the plaintiff, who was standing on a brass plate which was part of a tramcar. The car ran on for 80 yards, when the current was disconnected by the driver. The current prevented the plaintiff from moving or from calling out. His hand was burnt, and he suffered from traumatic neurasthenia. The date of the accident was July 20, 1907, after which he was treated at hospital, etc. He was seen by Sir Victor Horsley in January, 1908, who said the plaintiff had "severe traumatic neurasthenia consistent with electric shock," and thought that the plaintiff, if properly treated, might recover in six months.

[NOTE.—As far as one can epitomize the medical evidence for the plaintiff, it shows that with proper treatment, particularly that of Weir Mitchell, he should have recovered in six months. He does not appear to have had all the treatment advised, as he left the hospital and was no longer under the supervision and nursing he received there.]

He was still ill at the date of the trial, March, 1909. Damages £500, including estimate for loss of his motor-driver's licence and reserve pay as a reservist.

[Clark v. The Mayor, etc., of West Ham, 1909, *Times*, March 2 and 3.]

*Electric Shock, Electric Light Plant, 65 Volts ; "Convulsions" and Traumatic Neurasthenia—Accident not proved (W.C.A.).*—The applicant was a seaman on the s.s. *Montrose*, belonging to the Canadian Pacific Railway. The ship was lying in the London Docks. The man was walking along the deck where an insulated wire was lying, carrying a continuous current of 65 volts to a deck-lamp which was lighted. If any break in the insulating covering was present, the exposed piece of wire could not have exceeded 1 inch in length. Suddenly he gave a cry of "Charley, Charley, I'm on the wire!" He swore he had stepped on the wire, and that after that he immediately lost consciousness, and was unconscious for several hours. During this time, the evidence showed, he struggled intermittently and violently, with movements directly resisting several men who tried to keep him quiet.

At the time of the alleged shock the fuses did not blow, nor did the lamps go out. No burning was discovered afterwards on the wire or its inner or outer coverings, though one witness, for the man, swore he saw "blue flames some inches high" coming from the wire at the time.

The hearing lasted three days, and cost the respondents some £600, and on the first day the applicant produced his boots. They had two horizontal burns across the soles of each boot, being of such depth that the electric expert for the workman swore it would have taken five minutes to produce each burn. At the second hearing the boots were again produced, but the burns were not then present on both boots, but were only present on one. On the third day the man did not appear at all, and the boots were not produced at all, though called for by the employers' counsel. The electrician on board the ship said he connected the wires daily, and put his finger into the connecting-point after the current was turned on, as a quick and harmless method of finding out whether the current was "on" or not.

NOTE.—During the trial the editor with several experts examined the actual cable which had been in use during the evening of the occurrence, and found—

That the wires were twisted spirally round each other, and that when they were brought into contact with each other, while the current was running, one of the two fuses in the circuit at once was "blown." That, with the full current running, the lamps lighted, and the wires held, the sensation was not unpleasant even with wet hands.

The arbitrator held he had not proved his case.

[Nawson v. The s.s. *Montrose*, Bow C.C., Judge Smyly. Local papers, May 16, 1908, etc.]

*Shock, Electric Light Plant (Damages) (E.L.A.).*—A bargee was touching the side of a wet barge with one hand, and with his other wet hand caught hold of the chain of a crane with which the barge was being loaded. The continuous current of 200 volts from the electric

light main had escaped into the chain. He received a violent electric shock which prevented him getting free from the chain. After some shouting the current was cut off, and he fell back unconscious. He suffered from traumatic neurasthenia, with pain over the heart, in the back and head, and had a burn on the palm of his left hand. His own doctors thought he should be completely well in about a year from the accident.

Awarded one year's wages, £75.

[Laird v. Erith Oil Works, Dartford C.C., Judge Emden. Local papers, July, 1909.]

*Electricity ; Industrial Use of ; Currents do Harm—Negligence.*—Tramways of the defendants were driven by electricity, which deranged and spoilt the electric telephone system of the plaintiffs. The Telephone Company sued for damages, which they would have been able to recover but for the fact that the trams were run under statutory powers.

KEKEWICH, J. : " I cannot see my way to hold that a man who has created, or, if that be inaccurate, called into special existence, an electric current for his own purposes, and who discharges it into the earth beyond his control, is not as responsible for damage which that current does to his neighbour as he would have been if, instead, he had discharged a stream of water. The electric current may be more erratic than water, and it may be more difficult to calculate or to control its direction or force ; but when once it is established that the particular current is the creation of or owes its special existence to the defendant, and is discharged by him, I hold that, if it finds its way on to a neighbour's land, and there damages the neighbour, the latter has a cause for action. . . .

" Assuming the action to be maintainable on the principle of ' Fletcher v. Rylands,' the defendants rely on two answers to the Plaintiff's claim. First, they say that the plaintiffs might by an alteration of their system—that is, by the adoption of what is known as the metallic return—prevent the disturbance complained of ; and, secondly, they say that they, the defendants, are acting under statutory powers, and that if, in the proper exercise of those powers, they injure the plaintiffs, they are free from blame. The first answer is, to my mind, without foundation. The man who complains of his land being thrown out of cultivation by the incursion of water escaping from his neighbour's reservoir must not be told that he has no right of action, because, if he had interposed a wall, or otherwise taken care to protect himself, the water would not have reached his land. He is using his land in a natural way, and is not bound to take extraordinary precautions, and is entitled to rely on his neighbour also using his land in a natural way ; or, if he uses it otherwise, taking extraordinary precautions to prevent damage therefrom. There is, no doubt, a body of evidence to show that a system different from that adopted by the plaintiffs has been adopted elsewhere with advantage, and may possibly prove to be the most convenient, though more expensive, for them ; but the evidence also proves that their present system has been largely adopted, and is received with favour by many competent to form an opinion ; it also has the merits of economy. They are carrying on their own business



lawfully and in the mode which they deem best, and I cannot oblige them to change their system, because they might thereby possibly enable the defendants to conduct their business without the mischievous consequences now ensuing. True it is that the analogy introduced above fails to this extent, that the plaintiffs are using the land for an extraordinary purpose; but, admittedly, it is a lawful purpose, and, though under an obligation to obviate mischief from their own operations to their neighbours, they are under none, in my judgment, to protect themselves from the defendants or others. The outflow from one reservoir might easily destroy another; but, so far as I am aware, there is no principle or authority in English law for rejecting a claim for damage by the owner of the latter on the ground that his user, as well as that of the neighbouring owner, is extraordinary. . . . (But) the defendants' authority is derived under a provisional order confirmed by Act of Parliament. . . .

"To this plea of statutory power the plaintiffs have a rejoinder. They say that such power cannot avail the defendants unless they have acted reasonably in the exercise thereof, and have done their best to avoid injury to their neighbour. The argument being sound in law, one is compelled to examine the facts. . . .

"My conclusion from the evidence is that the defendants' system is, on the whole, the best which practical science has yet discovered; but there is no occasion really to go as far as this. It is enough to say—and about this I entertain no doubt—that it is at least as good as any other, and has been proved by experience, especially in the United States, where there have been larger opportunities for experiment and consideration, to be as likely as any other to meet the requirements of traffic and the convenience of all concerned. . . .

"It cannot be that, in the application of the law which I am now considering, the Court is bound to hold a railway or other company liable for the consequences of acts done under statutory powers, because it has not adopted the last inventions of ever-changing and ever-advancing scientific discovery."

[National Telephone Company *v.* Baker, Kekewich, J., 1893, 2 Ch., 186.]

NOTE.—This is an example of two points, neither of which is based on personal injury, though each of them might be material in a claim for personal injury occurring under circumstances similar to those here shown. The escape of electricity (or, as was more probable really happened here, the production of induced currents), if it causes harm, is objectionable. If, however, the electricity is used under statutory powers, which are exercised with due care, having regard to the purposes and object of the use, then, though it cause harm, no right of action exists in the injured person.

## 2. Lightning.

*Lightning—Accident within the Act (W.C.A.).*—A workman was struck by lightning and killed when working upon a scaffolding about 23 feet above the level of the ground.

COLLINS, M.R., adopted the judgment of the County Court Judge: "If I come to the conclusion that, as a matter of fact, the position in which the man was working was dangerous, and that in con-

sequence of the dangerous position the accident occurred, I could fairly hold that the accident arose out of the employment. . . . Then I am entitled to say that that extra danger to which the man is exposed is something arising out of his employment, and if, in consequence of that, a fatality occurs, I am entitled to say the section applies and the applicant is entitled to recover."

[*Andrew v. Failsworth Industrial Society*, 90 L.T., 611; 5 W.C.C., 11; 1904, 2 K.B., 32; 73 L.J., K.B., 510; 52 W.R., 451; 68 J.P., 409.]

*Lightning ; Death—Not an Accident within the Act* (W.C.A., Irish).—A workman engaged during a storm in cleaning out the gullies to prevent the water flooding a road was struck dead by lightning. No evidence was offered that the position of the man on the road exposed him to any greater risk of being struck by lightning than if he had been working in a field or garden.

Held: "That the accident was not one arising out of the employment of the deceased."

[*Kelly v. Kerry County Council*, 1908, 42 Ir. L.T., 23; 1 B.W.C.C., 194.]

NOTE.—This case is interesting, as it would appear that his occupation, bringing him in contact with water, might have been held to have exposed him to a greater danger than otherwise. (*Vide supra*, p. 11, Lord Trayner's dictum in *Falconer v. London, etc., Company*.)

### 3. Medically-applied Electricity.

*Electric Light Treatment ; Diabetes*.—The plaintiff was treated with a "Dowsing bath" for rheumatism, electric light carrying 250 volts being used for the bath. After he had left, he experienced a curious sensation in his big toe. He called in a doctor, who treated the toe for a burn, and eventually it recovered. Soon afterwards he was found to be suffering from diabetes.

BIGHAM, J.: "Do you say the damage to the big toe was responsible for the diabetes?"

ABEL THOMAS, K.C.: "It is suggested."

BIGHAM, J.: "This is a revelation to me."

The plaintiff did not succeed.

[*Harrison v. The Waterloo Electric Baths*, *Evening News*, June 4, 1910.]

*Electrical Treatment ; High-Frequency Burns—Negligence* (Damages).—The plaintiff on October 8, 1908, went to receive high-frequency treatment, with the advice of her doctor, Dr. Langford. She was given a sitting on a specially-constructed couch, being told to remove coins, etc., before commencing. She was told that there would be no pain, but as soon as the treatment was begun she felt sharp pain and burning sensations, at first in the right calf, and afterwards, when she moved, in the left ankle. She complained, but they said it was nothing, and they did not stop the current. When she got home she found distinct and visible burns on her legs. Dr. Langford at once recognized what they were, and that there was undoubted injury of a serious nature. There was serious inflammation and blisters. After some days this was followed by an attack of acute dermatitis, spreading all over her body, intensely irritating, with blisters on her arms and elsewhere. The burns healed

very slowly, and the effects of the illness lasted over seven weeks. Dr. Lewis Jones, when consulted, discovered that the cause of the burns was that sparking was caused by the metallic filament in the tinsel braid on the plaintiff's dress.

The plaintiff and Dr. Langford and Dr. Lewis Jones gave evidence in support of counsel's opening.

For the defence it was said that it was impossible to tell how the burns were caused, and the nurse who gave the treatment denied that the plaintiff had complained of pain at the time.

Dr. Arthur Whitfield and Dr. H. E. Crook said that they had never heard of a case where injury had been caused by the presence of metallic filament in the braid of a dress.

The Judge stated that the occurrence did not reflect on the defendant institution.

The plaintiff was given £60 damages by the jury.

[King's Bench, Channell, J., and common jury, *Times*, November 26, 1909.]

### EXPERT EVIDENCE.

It has been found more convenient to collect all the cases dealing with medical men under the heading of Medical Man, pp. 1000-1018, where those decisions dealing with expert evidence will be found.

### EYE.

In regard to the negligence of himself and others the legal position of a blind man is analogous to that of a deaf one. The deaf man's position is stated at the commencement of the cases under the title Ear.

The fact of the absence of vision from one or both eyes is hardly a controversial matter, but the legal consequences of incapacity from partial blindness, through total loss of vision in one eye or partial loss in one or both, is a most difficult question. These cases are divided into two classes—the one where the surviving eye is well and healthy; the other where the surviving eye is already diseased, or gradually becomes so after the accident.

Advancing age tends naturally to impair the eyesight quite independently of accident. Cataract in its various forms is exceedingly common in old age. The Scottish Courts have definitely held that old age, as a partial cause of incapacity, is no ground for the reduction of an award where incapacity due to the accident persists. (For blindness and old age, *vide supra*, Age, p. 864.)

### Insurance.

*Knowledge of Agent is Knowledge of Principal* (Insurance).—Bawden was an illiterate man, and was almost unable to read or write, but he could write his name. He had many years previously met with an accident which had entirely destroyed the sight of one of his eyes, and Quin, the agent to the insurance company, was aware that he had only one eye. Quin produced a printed form of proposal and filled up the blanks in it at Bawden's dictation, and Bawden then signed his name to it. The proposal was dated August 25, 1888.

It was upon a printed form, which was headed "Accident Proposal," followed by the name and address of the Company. Then came a number of questions to be answered by the person making the proposal (as to his age, profession, or occupation, etc.), with a blank opposite to each question for the answer. Then came the blanks for the insertion of the sum for which the policy was to be granted, and the amount of the premium. Then came the following clause: "Other Particulars": "I have not had paralysis or fit of any kind. I am in good health, free from disease, not ruptured, and have no physical infirmity, nor are there any circumstances that render me peculiarly liable to accidents."

On May 6, 1891, Bawden met with another accident, in consequence of which within three months he entirely lost the sight of his second eye, and became totally blind. On August 30, 1891, he died. Before his death he made a claim upon the company for £500 for permanent disablement. The company resisted the claim on the ground that the proposal on which the policy was based contained a misstatement. After the death of Bawden, this action was brought by his administratrix, claiming payment of £500 by the company.

In this case the question was to what extent the knowledge and authority as of such an agent as Quin bound the company.

Held: That it must be taken, first, that the assured had sustained a complete loss of sight to both eyes within the meaning of the policy; secondly, that the knowledge of the defendants' agent was, under the circumstances, the knowledge of the defendants, and that they were liable on the policy for £500.

[*Bawden v. London, Edinburgh, and Glasgow Assurance Company*, 1892, 2 Q.B., 534.]

(An appeal from a judgment for £500. Coleridge, C.J., and a jury, Cumberland Assizes.)

### Negligence and Assault.

*Eye; Blindness—Assault (Damages).*—On the evening of the fair-day at Milborne Port, October 28, 1770, the defendant threw a lighted squib, made of gunpowder, etc., from the street into the market-house, which is a covered building supported by arches, and enclosed at one end, but open at the other and both sides, where a large concourse of people were assembled; which lighted squib, so thrown by the defendant, fell upon the standing of one Yates, who sold gingerbread, etc. That one Willis instantly, and to prevent injury to himself and the said wares of the said Yates, took up the said lighted squib from off the said standing, and then threw it across the said market-house, when it fell upon another standing there of one Ryal, who sold the same sort of wares, who instantly, and to save his own goods from being injured, took up the said lighted squib from the said standing, and threw it to another part of the said market-house, and in so throwing it struck the plaintiff, then in the said market-house, in the face therewith, and the combustible matter then bursting, put out one of the plaintiff's eyes.

NARES, J., was of the opinion that trespass would lie well in the present case. That the natural and probable consequence of the act

done by the defendant was injury to somebody, and therefore the act was illegal at common law.

And the throwing of squibs has, by statute W. III., been since made a nuisance. Being therefore unlawful, the defendant was liable to answer for the consequences, be the injury mediate or immediate. 11 Henry VII., 28, is express that *malus animus* is not necessary to constitute a trespass.

“. . . I do not think it necessary, to maintain trespass, that the defendant should personally touch the plaintiff; if he does it by a mean, it is sufficient. *Qui facit per alium facit per se*. He is the person who, in the present case, gave the mischievous faculty to the squib. That mischievous faculty remained in it till the explosion. No new power of doing mischief was communicated to it by Willis or Ryal. It is like the case of a mad ox turned loose in a crowd. The person who turns him loose is answerable in trespass for whatever mischief he may do. The intermediate acts of Willis and Ryal will not purge the original tort in the defendant. . . .”

DE GREY, C.J.: “. . . It has been urged that the intervention of a free agent will make a difference; but I do not consider Willis or Ryal as the free agents in the present case, but acting under a compulsive necessity for their own safety and self-preservation. On these reasons I concur with brothers Gould and Nares that the present action is maintainable.”

[*Scott v. Shepherd*, 1 S.L. Cases, 342; 2, Blackstone, 892.]

NOTE.—This is the famous “Squib” case which is here given as an example of an assault and the proximate cause of an injury. See above, Accident and Accidental Injuries, p. 5.

### Workmen's Compensation Act.

Since the scheduled diseases have been added to the Workmen's Compensation Act, the following scheduled diseased conditions of the eye, when they arise out of and in the course of the employment, enable the workman to recover compensation for the disability they produce:

1. Miner's nystagmus.
2. Glass-blower's cataract. Compensation is only payable for a maximum period of six months, provided an operation is performed and the eye is cured. (*Vide supra*, Operation, p. 29.)
3. Eye diseases which arise under the heading of Ulcerations of the Corneal Surface of the Eye due to Pitch, Tar, or the Tarry Compounds.

For other diseases which may affect the eye, see the title—*e.g.*, Anthrax.

### Loss of One Eye.

The opinions and awards of different arbitrators vary enormously as to what effect is produced upon a workman by the loss of one eye. Awards which appear to be exactly opposite and to deal with the same class of case have been given, in the one case holding the injured man can do his old work, in the other case holding he cannot. In each case the Court of Appeal appears to consider the question to be chiefly one of fact—at all events, the

awards have not been disturbed. Cases where one eye has been lost are here classified under two heads—in the first, the capacity to do the old work was held to be altered in whole or part; in the other case, it was held not to be diminished, though of course an open award must be made.

*Capacity for Work affected (totally or partially).*

*Bricklayer—Return to Partial Work—Amount of Compensation (W.C.A.).*—Blake lost his eye by some piece of pipe getting into it. His wages had been 32s. 10d. per week as a foreman bricklayer, and he was receiving 16s. 5d. per week compensation. He could, according to the evidence, earn 20s. at least now.

It was contended that his work required perfect vision of both eyes, and that it would be very dangerous for him now to go on a scaffolding. He had not known until the accident what it was to be ill. He was admittedly an excellent workman, and he asked that no reduction should be made at present. (For the award see below, *Laurence Scott v. Goodson.*)

[*Hipperson v. Blake*, Judge Mulligan, Norwich C.C.; 128 L.T.J., February 5, 1910.]

*Electrical Labourer—Return to Partial Work—Amount of Compensation (W.C.A.).*—Goodson had been earning 31s. 10d. per week in the electrical works of Laurence, Scott and Co. He lost his left eye through a piece of lead getting into it, and he was receiving 15s. 11d. a week compensation. He had returned to work, but could not work full time because he could not judge distances without great strain, and if he worked long he suffered with pains in the head. His average earnings now are 14s. 4d. a week.

It was contended for Goodson that he had now to run greater risk in his work through the loss of his eye, and that half the difference between 14s. 4d. and 31s. 10d. was not enough. It was suggested that though there was no precedent for it, the award should be made on a sliding scale, varying according to the actual earnings from week to week. Goodson said he would not object to a sliding scale if the award could be so framed.

His Honour said he had no power to lay down a general rule even if he thought it desirable. Each case must depend on its own circumstances. Perfect vision was more valuable in some trades than in others. According to the medical testimony, a moderate amount of work would do these men good. If there was no precedent for an award on a sliding scale, he had no hesitation in making one for this circuit in order to carry out the act. Taking into consideration all the circumstances, including the fact that good stereoscopic vision was requisite for earning anything like good wages in the trades in which these men were employed, he awarded until further order in each case a sum per week equal to two-thirds of the difference between what he shall actually earn per week from time to time and his average weekly earnings before the accident, but not exceeding 15s. 11d. in the one case, and not exceeding 16s. 5d. in the other case. The concise form of award prepared by the Registrar (Mr. Cook) in Blake's case was: "Award 16s. 5d. per

week, or a sum equal to two-thirds of the difference between his actual earnings and 32s. 10d., whichever sum shall be the less.

[*Laurence, Scott and Co. v. Goodson*; Judge Mulligan, Norwich C.C.; 128 L.T.J., February 5, 1910.]

*Engine-fitter* (W.C.A., Scottish).—Engine-fitter lost the use of one eye.

Held: "He has been incapacitated from following his occupation, and since the accident has not been able to earn anything."

[*Jackson v. Rodger and Co.*, 1900, 2 F., 533.]

*Gardener* (W.C.A., County Court).—The applicant, while hoeing in a garden, was struck in one eye by a fragment of flint or other substance, thereby losing the use of his eye, and necessitating its removal. He then returned to work at 16s. weekly. His wages before the accident were not less than £1 weekly. He claimed the full difference between his old and new wages—*i.e.*, 4s. weekly. His master offered 2s. weekly.

The Judge held that the Act did not contemplate complete indemnity, entitling the man to the full difference between his wages before and after the accident; but taking into consideration that there was a greater risk of injury to the surviving eye, he awarded him 3s. weekly compensation.

[*Mills v. Voysey*, Worthing County Court, Judge Scully, 1909; *Policy Holder*, vol. xxvii., March 31.]

*Mason* (1897, W.C.A.—*Medical Referee's report under Schedule 1 (2) Scottish*).—In consequence of an accident, the vision of the left eye was seriously defective, the right eye remaining healthy. Certificate of one of the medical examiners appointed for the purposes of this Act: "His disability is, however, at present great enough to unfit him for his usual occupation of mason's labourer, though I am of opinion he is quite fit for any work where he would not have to exercise for the safety of life and limb that nice discrimination as to distances for which the sight of two eyes is necessary."

Held: "Incapable of following his old employment of mason."

[*Bryce v. Connor*, 1904, 7 F., 193.]

*Miner*—*His former work at the coal face held not to be "Suitable Employment."*—Eyre, who was a coal miner, met with an injury to his eye while getting coal in a mine. The accident produced a permanent injury to the sight of that eye, which made the applicant less fitted for work. The employers offered him work at the coal face at the old wages, but he declined this offer, and asked for work at the surface of the mine, and that his wages in respect of that work should be supplemented by the payment of compensation under the Workmen's Compensation Act, 1906. In the arbitration proceedings the County Court Judge found that there was an appreciable increase of risk to the applicant's remaining eye, and of injury generally in working at the coal face, and in those circumstances he was of opinion that working at the coal face was not quite a suitable employment for the applicant. He refused to make a nominal award, but gave the man substantial compensation. The employer appealed.

COZENS-HARDY, M.R., said "that the appeal raised a question as to the meaning of Clause 3 of the schedule to the Workmen's Compensation Act, 1906—namely, what was the meaning of suitable employment. In the first place, that seemed to His Lordship to be a question of fact in each case, which must be answered by the County Court Judge, having regard not only to the physical condition of the man, but also to the nature and character of the work offered to him after the accident. In the present case the learned County Court Judge, having heard the evidence, said that the employment offered was not quite suitable. His Lordship did not read the judgment in that sense. In his view the judgment negatived the idea of the employment offered being suitable employment. If there was any evidence to justify that as a finding of fact the Court could not interfere. It was not necessary, and it would not be right for him to say that on the evidence he would have found as the learned judge did, but it was impossible to say that there was no evidence to justify the learned judge's finding that the employment offered was not suitable. The appeal must be dismissed."

FLETCHER MOULTON, L.J., delivered judgment to the same effect.

BUCKLEY, L.J., in the course of his judgment, said "that it appeared to him that the question was one of mixed law and fact. It was necessary first to decide what was the meaning of suitable employment in the Act, and then whether the employment offered in the particular case was suitable. The employment offered in the present case could not have been deemed unsuitable merely on the ground that an accident to the remaining eye to a man with only one eye was more serious than an accident to the eye of a man who had two. The learned County Court Judge had, however, found as a fact that the employment offered involved greater risk to a man with only one eye, and was therefore unsuitable. He (Buckley, L.J.) did not think that he himself would have come to the same conclusion, but there was evidence to support the finding, which must stand."

[*Eyre v. Houghton Main Colliery Company, Ltd.*, Cozens-Hardy, M.R., Fletcher Moulton and Buckley, L.J., 1910; 3 B.W.C.C., 250.]  
(*Per contra*, *Cawdor Collieries v. Jones*, *infra*, p. 939.)

*Stone-breaker* (W.C.A., Scottish).—A chip of steel entered one eye, which became blind.

Held as a fact, upheld by Court of Sessions: "No longer fit for work as a stone-breaker."

[*Doharty v. Boyd*, 1909, S.C. 89.]

*Stone-dresser* (W.C.A., Scottish).—Injury leading to loss of one eye. "Since the date of the injury he has been unable to earn wages as a stone-dresser."

[*Petrie v. Weir*, 1900, 2 F., 1041.]

*Capacity for Work unaffected.*

*Blacksmith* (W.C.A.).—The applicant, an apprentice to a blacksmith, lost the use of his right eye. Dr. Leak proved theoretically that a one-eyed blacksmith could not do his work as skilfully as a sound man, also that he ran the risk of losing the sound eye. The



employer called Dr. Edward Brown, who stated he knew scores of blacksmiths who worked with only one eye, and that it was quite possible for a man to work as a blacksmith with one eye. Three independent working blacksmiths were called who had each lost an eye, and stated that they could do their work efficiently and were earning the union rate of wages.

His Honour decided that the applicant was not entitled to any compensation, but continued an open award already in existence.

[*Moulton v. The Salt Union, Ltd., Northwich C.C., Judge Reginald Brown, January 2, 1909, 126 L.T.J., 193.*]

*Boiler-maker: One Eye Blind, Other Eye Sound* (W.C.A., Scottish).—Report of Dr. Shaer as Medical Referee on the loss of the one eye:

“In my opinion, a one-eyed man runs a slight additional risk to this eye in a dangerous occupation, such as that of a boiler-maker. If, however, the parties concerned have decided to incur this slight risk, I see no reason why J. W. Woodward should not at once return to his former occupation. I am of opinion that for some weeks J. W. Woodward will not be restored to his full earning capacity for the following reason: owing to the loss of one eye, he will have difficulty in correctly judging the distance of objects. This would particularly apply to the striking of a rivet with a hammer; but with practice this awkwardness will disappear, and he will learn to judge correctly of distance with his one eye.”

Held: “The workman was able to earn the same amount of wages as before the accident, and an award would be made of one penny weekly.”

[*Morton and Co. v. J. W. Woodward, 1902, 86 L.T., 878; 4 W.C.C., 143.*]

*Laundry-maid* (W.C.A.).—A laundry-maid lost one eye, and after a period of time returned to her work, from which she was subsequently dismissed when the hands were reduced. She then tried to get other work, but did not succeed on account of her absent eye, but admitted she was quite capable of doing her old work with one eye. The Recorder held she was not incapacitated from her work as a laundry-maid, and refused to give her any compensation.

[*Belfast, before the Recorder, February 15, 1909, 43 Ir.L.T.J., 99.*]

*Miner*.—A miner, who long ago lost one eye, continued to work for many years, when the other eye was injured. This case was one where loss of the first eye occurred before the Workmen's Compensation Act came into force, when there was no alternative but for the man to go back to work. This he appears to have done at the full rate of wages.

[*Jamieson v. Fife Coal Company, 1903, 5 F., 950.*]

*Miner* (W.C.A.).—Jones, who was a collier working underground, was, on September 25, 1905, injured by an accident by which he lost the sight of his right eye. The employers paid him compensation at the rate of 18s. a week by an agreement made on October 10, 1905. On March 16, 1908, the employers found the workman light work, and an agreement was made reducing the amount of com-

pensation. On January 12, 1909, a memorandum of that agreement was recorded, the reduced compensation being 13s. 4d. a week. On January 30, 1909, the employers made an application for review of the weekly payment.

The following is quoted from the Judge's notes:

"*Dr. Thomas*: Right eye is painless, no inflammation, no further trouble. Left eye not likely to be affected, normal, quite recovered. Physically fit save for the loss of the eye. Plenty of men with one work underground.

"*Cross-examined*: Earning capacity of men with one or two eyes. *More risk* with one eye.

"*Thomas Jones* (manager of company): One man lost eye underground earns full wages. Another case at Celliceidrim Colliery.

"*Cross-examined*: Earns wages on the surface £1 4s. 9d. as against £1 16s. No doubt there is partial incapacity by loss of one eye inasmuch as he cannot see dangers and avoid them, but that risk is not very great.

"*Dr. J. Williams* (for the workman): He is physically fit; there is a risk with loss of one eye."

His Honour made the following award:

"I find that the wage-earning capacity of the respondent by the loss of his right eye does not prevent him from earning full wages. As others go underground, why should he not go? I reduce the compensation to 1d. a week."

From this decision the workman appealed.

COZENS-HARDY, L.J.: "The question for the County Court Judge is—aye or no. Is the workman in such a condition that the compensation payments ought to be reduced? It is quite plain that there was evidence before the County Court Judge which enabled him to diminish the amount of compensation. He has to hear evidence whether the man is competent to resume his former work at his former wages. I have listened in vain to ascertain whether it could be shown that there was any misdirection here. The County Court Judge has found that the workman was not prevented by the loss of his eye from earning full wages, and that there was no reason why he should not work underground as others did who were in like condition."

[The Cawdor and Garnant Collieries, Ltd., *v.* Jones, 3 B.W.C.C., 59.]

(*Per Contra*: *Eyre v. Houghton Main*, *supra*, p. 937.)

*Unskilled Workman* (W.C.A.).—A workman was injured in one of his eyes, and after some time returned to work, receiving reduced compensation, apparently simply on the ground that the man could not get work. The Judge awarded him half-wages, without taking into consideration whether or not the man's area was in fact circumscribed by reason of the accident. On appeal it was held that the Judge was wrong.

COZENS-HARDY, M.R.: "I think this Court has more than once laid down that the employer does not guarantee the state of the labour market."

FARWELL, L.J.: "The Judge has simply assumed that the employer

is bound to give work when he has not got it, which is not the meaning of the Act."

Held: "The application must go back to the Judge."

[*Dobby v. Wilson Pease and Co.*, Court of Appeal; 2 B.W.C.C., 370.]

### Damages, and Amounts paid in Redemption of Weekly Payments.

*Eye* (W.C.A.).—The master, in compensation for the loss of one eye, paid his workman 10s. per week for some time, and then applied to register an agreement for £20 in full settlement for the loss of the eye. The Judge of Bury County Court refused to register the agreement.

[Name of case not given. 1908, *Policy Holder*, xxvi. 324.]

*Eye Injured (Contract or Tort)*.—A railway company provided on their own property, as an exit, a path which they knew to be dangerous from flying sparks from the starting trains. There had been a petition to the railway pointing out the danger of the path, though it was admitted that, as regards the engine itself, there was no negligence. A spark injured the plaintiff's eye. Damages £25.

[*Atherton v. London and North-Western Railway Company*, 1905, 21 T.L.R., 671.]

*Left Eye totally Destroyed* (W.C.A.).—A workman had lost the left eye, and after some time the employers (the insurance company) paid him £45 in full redemption of their liability.

The Judge refused to register the agreement on the ground of inadequacy, but adjourned the case for a month to see if the man would benefit by an operation it was proposed to perform.

[Name of the case unreported, City of London Court, Judge Lumley Smith, *Post Magazine*, May 8, 1909, vol. lxx., p. 371.]

*Eye Injured—Dangerous Nature of Goods known to Seller (Contract)*.—The plaintiff bought a tin of chlorinated lime, and as she opened it some flew into her eyes. The tin was badly constructed, and there was evidence that other tins of the same consignment had been complained of for the same reason. The manager had told the salesman to warn purchasers, but he did not do so. Defendants were held liable on the ground that they were negligent in not warning the plaintiff of the possible danger, which was concealed but of which they were aware. Damages.

[*Clarke v. The Army and Navy Co-operative Society*, 1903, 1 K.B., 155.] (*Vide infra*, p. 955.)

### Loss of Both Eyes.

When the loss is due to the accident itself, the legal position is clear; but there are several cases under the Workmen's Compensation Acts where the injured workman has in effect become totally blind by the loss of a surviving eye, or by the surviving eye being diseased.

*Loss of One Eye, the Other already Blind; Insanity* (W.C.A., Scottish).—Loss of the surviving eye was followed by insanity, which the Court held could not be taken as a possible consequence of the injury. (*Vide infra*, *Insanity*, p. 977.)

### Disease existing before the Accident.

*Old Cataract due to Natural Causes ; Accident alleged—Medical Referee reported that the Disease was of Long Standing (W.C.A.).*—The applicant was a weaver, and stated that, when working with a shuttle, one of her eyes sustained an injury, for which she claimed compensation. The evidence of the medical men being contradictory as to the cause of the defective vision, the County Court Judge referred the matter to the medical referee, who found that she was suffering from a “cataract arising from natural causes.” His Honour, acting on this report, declined to make any award in her favour, and the Court of Appeal refused to upset his award.

[*Southward v. Oxhey’s Cotton Spinning and Manufacturing Company, Court of Appeal, on appeal from the County Court of Preston, Post Magazine, August 10, 1907, p. 621.*]

*Loss of One Eye, the Other being affected with Nystagmus.*—A miner received an injury to his right eye, rendering it almost useless. The left eye had nystagmus at the time of the accident, which got worse. The nystagmus was neither caused nor aggravated by the accident. It was found that, on account of nystagmus, he was partially incapacitated for work, it being presumed that the injured eye had not nystagmus at the time of the injury.

LORD MACKENZIE: “This is the case of a man who at the time of the accident had one sound eye, and one eye which was affected by an infirmity—nystagmus. . . . It is the law that if a man who is already afflicted with an infirmity is injured by an accident, and thereby incapacitated from carrying on the work which he was previously fitted to do, then that is an injury which results from the accident, even though the accident would not have incapacitated him had he been otherwise sound.”

Held: “That the workman is still prevented by the results of the injuries caused by an accident mentioned from resuming his former employment.”

[*Lee v. Baird, 1908, 45 S.L.R., 717; 1 B.W.C.C., 34.*]

### Disease.

*Cataract due to Old Injury ; New Injury—New Accident (W.C.A.).*—Martin, a carman, received a blow on the temple ten years ago which rendered his left eye useless for many purposes. On June 22, 1909, the swish of his horse’s tail struck him in this damaged eye. Feeling severe pain, he went to a hospital, where the eye was removed.

Dr. Harpon (for the workman), Ophthalmic House Surgeon at the London Hospital, first saw applicant on August 6; he said that the man had been examined by Dr. Scott, his predecessor, and the next witness, on June 23, and that he had been under himself from August 6. In his opinion the swish of the horse’s tail aggravated the condition and necessitated the removal of the eye.

Dr. Harold Monroe Scott (for the employer) formerly Ophthalmic House Surgeon at the London Hospital: “Martin came to me on June 22, 1909. He said he had received a swish over the eye that

morning, and the pain was increased. Said ten years before he had been kicked, and that for the last three years his eye had been failing until sight was gradually lost. He said the pain had been agonizing at times, but not continual. He said sight first failed on right side of the left eye, and then gradually passed across to the other side. If this was correct, it showed the damage behind was increasing or a cataract was gradually increasing. Cornea was bright; the iris bound down to the lens. The lens in a condition of cataract, the conjunctiva was red, and the tension was hard or high. I tested his vision with that eye; he could see hand movements. This means little more than distinguishing light from dark. I removed the eye.

"The condition of the eye was due to the accident ten years previously. The blow (recent) had caused further pain. The redness of the conjunctiva came from the blow."

The County Court Judge found the facts to be as follows:

"That the man's left eye had been for some time failing, that it had a cataract of old standing. Was a danger to the other eye, and from time to time gave applicant pain, but such pain did not and had not in fact prevented him from doing his work and doing it well.

"That he received a blow on the left eye from the horse's tail, which produced inflammation and greatly accentuated and increased the condition of the left eye and increased the pain in it, and that the inflammation and pain was partly the reason for the eye being removed.

"I find that had the applicant not had the misfortune to have been struck with the horse's tail, there was no reason why the applicant should not have gone on for a time doing his work—for what the length of that time would have been I have no means of judging, as I think that would have entirely depended on the condition of the right eye.

"I find that the applicant could see very little with the injured eye prior to this accident, but that the other eye was being adapted to the circumstances as they arose, and the applicant did and would not find the want of the failing left eye until the other eye gave way.

"I find that the applicant is not yet fit for work because of operation.

"On these findings I hold the accident was the immediate cause of the stopping of the applicant's work, and that the applicant is entitled to an award of 15s. a week from date of the accident until award varied or ended."

The employer appealed and failed.

[*Martin v. Barnett*, on appeal from Bow C.C., Judge Smyly, 3 B.W.C.C., 146.]

### Not Arising out of and in the Course of the Employment.

In a number of cases injuries to the eyes of workmen have not enabled them to recover compensation, as the accident was held not to have arisen out of and in the course of the employment (*Workmen's Compensation Act, 1906, Section 1*).

*Insect Injures Eye—Cockchafer.*—A servant-girl was seated at a window doing work, within the scope of her employment, and saw

a cockchafer flying in at the window; she put up her hand to prevent the insect hitting her face, and in so doing injured her eye. This was held to be an accident which did not arise out of the employment, though it was in the course of it.

[*Craske v. Wigan*, 1909; 1 K.B., 371; 2 B.W.C.C., 35.]

*Assault*.—A workman for no apparent reason deliberately pushed a fellow-workman, who, in trying to prevent himself falling over a moving rope, swung up his hand which was holding a hammer, and injured the other workman's eye.

Held: "That the accident did not arise out of and in the course of the workman's employment."

[*Shaw v. The Wigan Coal and Iron Company, Ltd.*; 3 B.W.C., 81.]

### Operation.

For operation of cataract, *vide supra*, Statutory Operation, p. 29.

### Recurrence.

*One-eyed Man—Injury to Other Eye followed by open Award—Recurrence at Later Date* (W.C.A.).—A workman had a blow on his face in November, 1903, which destroyed the sight of one eye. Though still in receipt of a nominal award, he went back to work in July, 1906, his remaining eye continuing to be sore and weak. In May, 1908, he got some dust in this remaining but sore eye, and in consequence was prevented by the inflammation from working. In the interval between the two accidents the master had changed his insurance company, and so the point was of some importance. It was contended by the one company that the entry of the dust was a new accident to a weak eye; the other company said that, on the contrary, the inflammation was due to a recurrence of the conditions caused by the first accident. The arbitrator held that it was not a new accident, but a recurrence, and against this award the aggrieved company appealed.

[*Gallaher v. Crossfield*. Unreported, Court of Appeal List, March 30 to May 21, 1909.]

For other cases of injury to the eye, see Age, Brain (Softening following Injury to Eye), at p. 864; Insanity, at p. 977; The Malingering, at p. 996.

### FASCIÆ.

The legal importance of fascia is chiefly the opportunity for malingering given by slight inflammation, of a pneumatic kind, of the various fasciæ—*i.e.*, fibrous partitions, coverings, and expansions, of tendons. Pains in the back, shoulder, or neck, the result of causes which may be classified together as rheumatic or gouty, are the inevitable consequence of a life with a good deal of exposure, especially if associated with a little more alcohol than is good for the sufferer, who is not necessarily by that a drunkard. This type of individual in many cases has had no medical treatment other than that obtained from the rubbing of his back with white horse-oils or somebody's embrocations, so that he and his wife can go into the witness-box and swear that, until the workman lifted that particular box, "he never had a day's illness in his life." There is a common

deformity, known as "Dupuytren's contraction," which is associated with inflammation of the palmar fasciæ, and is described in the article upon Fascia, p. 339; this might be claimed as a consequence of injury. It is impossible here to quote all the cases of "pain in the back." They are of daily occurrence in the Courts.

## GANGRENE.

Senile and diabetic gangrene are both common in old age and diabetes respectively, without it being necessary to have an injury to produce them.

**Gangrene (W.C.A.).**—A gamekeeper was shot in the leg by his employer, and gangrene set in, so that the leg had to be amputated. This is an example of the sort of case in which gangrene might be expected after such severe injury to the vessels.

[*Smith v. Coles*, 1905, 93 L.T., 754; 22 T.L.R., 5; 8 W.C.C., 116.]

**Frostbite.**—For other cases of gangrene caused, or alleged to be caused, by accident, see Cold, Electricity.

## GENITAL ORGANS—FEMALE.

The chief consequences of injury to the female genital organs that are likely to be before the Courts are—

1. Prolapse of the womb.
2. Premature labour, miscarriage, or abortion.
3. Injury to the child within the womb.

### 1. Prolapse of the Womb.

*Prolapse or Descent of the Womb (W.C.A.).*—In this case the Court of Appeal held that, under the following circumstances, there was no accident; but this decision has since been held to be overruled, so that we may consider that the following is an account of a personal injury by accident:

A woman, who was already suffering from prolapse of the uterus (descent of the womb), was ordered to cover some boxes with paper. She had completed six, and was lifting up the seventh, when "she suddenly felt great pain and fell down in a faint." She was taken home, and was disabled for a long time, in consequence of a prolapse of the womb having become suddenly worse.

[*Roper v. Greenwood*, 3 W.C.C., 23; 83 L.T., 471.]

*Prolapse of the Womb (W.C.A.).*—The applicant was a fairly healthy looking domestic servant, aged forty-five, who claimed that, in consequence of an accident "about Christmas," 1908, she was suffering from a prolapse of the womb. For the six months preceding this date, with the assistance of the gardener, she had been in the habit of carrying her mistress up and down stairs in a carrying-chair. She never complained to him at any time of anything more

than that she had a pain in her side. There never was anything of the nature of any sudden occurrence.

In October, 1908, before the date of the alleged accident, she found her monthly periods were painful; in November, 1908, she had a fall, and about Christmas-time she found a "lump" in her outside parts.

She saw Dr. Tuthill, who gave her an instrument to wear; but she had so much pain that she left her employment in June, 1909, and went into hospital for an operation.

The respondent's contention was that the malady was the result of a gradual strain, and not due to any accident.

Dr. Tuthill said that after the instrument (a pessary) was introduced by him in January, 1909, the condition would not have progressed, and admitted that the mouth of the womb (cervix uteri) was  $1\frac{1}{2}$  inches long in June, 1909, and that the front passage was lax and loose. He also said that, considering the anatomy of the parts, in order that the mouth of the womb should reach and remain at the outside parts, where he found it on examination in January, 1909, it would have to have descended about 2 inches. It could only do this by a process of stretching, to a corresponding extent, of the internal parts which support the womb.

His Honour said that, in his opinion, and that of the medical assessor and of the applicant's own doctor, the prolapse arose gradually.

That there was no evidence of any "accident," and that though the complaint might have been caused by the employment, it could not be said to have arisen from any accident.

[Tucker v. Lane, Poole County Court (Dorset), Judge Philbrick, K.C., with Dr. C. H. W. Parkinson, medical assessor. Local papers, March 12, 1910.]

*Prolapse of the Womb* (W.C.A., County Court).—The applicant, a domestic servant, claimed that she was suffering from a prolapse of the womb. The prolapse, she said, was due to using a light combined wringer and mangle in the month of August, 1909. She said she felt something "*lifting up and going down bump*" at the time. In cross-examination, she admitted that she had had a discharge, which had gradually increased for nine months before August, although she had previously stated that she was in perfect health before August. She called no doctor, but attempted to use as evidence a medical certificate from Dr. Crawford, who had not seen her till long after August. She also admitted that, on September 15, she attended the London Hospital. Dr. Austin, who attended her at the London Hospital, was called by the employer, and he said that he had then examined her; had found no prolapse, but a small polypus, which he had removed, and he considered that polypus had caused all her symptoms.

The following is a shorthand note of his Honour's award:

"In this case I was glad to have the assistance of the medical referee sitting with me, because it is a case in which the real question was, to a great extent, a medical question, and unfortunately the applicant had no medical evidence of any sort or description. . . .

"In this case the applicant claims compensation on the ground that



she had on some date about the middle of last August an accident which caused displacement of the womb. I find upon the evidence that was given, which I will go into more fully presently, that the applicant has failed to establish:

"1. That there was any accident at the time she alleges or at any other time;

"2. That there was any such displacement of the womb at the time she alleges, or in the month of August.

"Dealing with the second finding first, the applicant's only ground for contending that there was a displacement of the womb was a certificate which was put in evidence, but which I could not admit as evidence, of Dr. Crawford, enclosed in a letter from the applicant to the respondent. If I had thought I could decide the question by giving the applicant the chance of calling Dr. Crawford, I should have offered to have adjourned the case for Dr. Crawford's attendance. But even if he had been called, and had proved there was a displacement of the womb on October 22 or 23, it would not have altered my finding, as I had been advised by the medical referee that if there had been a displacement of the womb on September 15, when Dr. Austin examined the applicant at the London Hospital, it must have been discovered, because the examination which disclosed the polypus which was at that time removed must, from the position of the polypus, have disclosed the displacement of the womb; and Dr. Austin is quite clear that on that day (September 15) there was no displacement, and if there was no displacement of the womb on September 15, it is perfectly clear there was no displacement of the womb about the middle of August. Furthermore, I am advised by the medical referee that turning a mangle would not cause a displacement of the womb even in an unhealthy person, still less in a healthy person, but that direct violence (of which there is no evidence whatsoever) might, in an unhealthy person, cause a displacement of the womb. The medical referee also advises me that the sensation of something "*lifting and going down bump*," in the words of the evidence, would not be such as a displacement of the womb would cause. The polypus would undoubtedly account for the loss of blood which had been going on and gradually increasing at the periods for the last eighteen months, and would induce a condition such as the applicant suffered from in the middle of August—a condition of collapse and want of strength. The applicant's own evidence was fairly given, but certainly failed to prove an accident. If the mangling of the heavy curtains which she spoke of as taking place some eighteen months or two years ago had occurred within a shorter period, she would certainly have attributed the accident to that, and not to the mangling in August, when she admitted that she was mistaken, or probably mistaken, in saying she had any curtains to mangle. She seems to have pitched on the middle of August for the accident, because, not knowing of the polypus, she concluded there must have been some accident to cause her then state of health

"On these findings I am bound to award in favour of the respondent."

[Sands v. Coppen, Bow C.C., Judge Smyly, with Dr. Benthall medical assessor, February 28 and March 8, 1910.]

## 2. Premature Labour, Miscarriage, or Abortion.

*Miscarriage*—"Illness or Infirmity" (Insurance).—Exact words of the question in proposal form: "(3) Whether she had suffered from any local or other disease, personal injury, or infirmity." Answer: "Had none."

The policy was indisputable, after two years' existence, except on the ground of fraud, and *bona-fide* mistakes were not to count as fraud.

The policy was for £2,000, and was issued on July 4, 1904, and the insured died on October 11, 1907. The insurers disputed the policy on several grounds—*inter alia*, that it was discovered that in 1894 she had had a miscarriage requiring the use of a curette. (NOTE.—This probably means that, as is not uncommonly the case, the entire contents of the womb were not expelled when she had the miscarriage, and some part had to be removed with a scraping instrument called a "curette.") It was admitted that she had not been guilty of fraud.

Held: "The policy was indisputable, and not invalidated, as no fraud was alleged or proved. A miscarriage is not 'an illness or infirmity.'"

Judgment for the plaintiff for £2,000 and costs. The judgment was upheld by the Court of Appeal.

[*Anstey v. The British Natural Premium Life Assurance, Ltd.*, King's Bench, Cardiff Assizes, Bray, J., 1908; *Post Magazine*, lix. 360; Court of Appeal, p. 610.]

*Miscarriage—Direct Violence* (Damages).—The plaintiff, who was pregnant, had been engaged as a shooting-gallery attendant. On September 13, while on a motor-bus, she was thrown violently on the floor by a collision. A few days later premature confinement followed. Some time after she again became pregnant, and again miscarried. Apparently the plaintiff's contention was accepted that both miscarriages were due to the accident. Damages £100.

[*Boulter v. L.C.C., Clerkenwell C.C.*, Judge Edge. Local papers, May 11, 1908.]

*Miscarriage; Shock—No Direct Violence* (Damages).—The plaintiff was behind the bar of her public-house, when a carter drove his horse through her window into the bar, but did not touch her. The fright and shock was held to have caused premature confinement three and a half months after, and her child was born an idiot.

Damages were awarded for the miscarriage, but not for the idiocy of the child, that fact being held too remote.

[*Dulieu v. White*, on appeal 1901, 2 K.B., 669.]

## 3. Injury to the Child within the Womb.

*Stillborn Child; Shock* (Damages).—The plaintiff, the wife of a greengrocer, was injured on a L.C.C. tramcar on July 18, 1907, and on February 19, 1908, she claimed that she had been unable to carry on her work since the accident, which had caused the birth of a still-born child. All her other children had been born healthy. The

Judge allowed £10 for the pain and suffering, and a further £15 13s. for special damages, including loss to her business and medical attendance. Total damages £25 13s.

[Taylor v. L.C.C., Greenwich C.C., Judge Willis. Local papers, February 21, 1908.]

## GENITAL ORGANS—MALE.

**Urethra**—*Injuries ; Traumatic Stricture*.—Rupture of the urethra, caused by such an accident as falling astride a bar, is a common injury; but the newspaper reports rarely state the nature of actual injury sustained.

**Hæmatocele**—*Injury to a Diseased Part (Damages) (E.L.A.)*.—A fat workman was building in an area which was so narrow that, while his back was against one wall, his stomach was only 2 inches from the front wall which he was building. He claimed that some of the loose "made soil" slid down on him from a foot above his waist and struck his testicle. He admitted having an old hydrocele (excess of fluid in the covering of the testicle), and said that the falling earth caused his present trouble, which was a hæmatocele. He said the injury gave him no reason to complain of immediate pain, and that he continued to work as a builder for the rest of the day.

"Accident" was admitted by the insurance company, and the Judge, taking into consideration that the covering of his testicle was already diseased, and that the hæmatocele would be cured by a small operation, awarded £60 damages.

[Keep v. Brown, Lambeth C.C., Judge Emden. Local papers, February, 1908.]

**Testicle**—*Injury alleged ; Gonorrhœa (W.C.A.)*.—The following is a case which is so typical that it is quoted here by permission, though it was not fought. When it was put before counsel for an opinion on the claim, he at once advised that a medical report should be obtained as to the presence or absence of gonorrhœa. The result was satisfactory to the employer. The workman was engaged in service, when he said he slipped and in some way hurt his right testicle. He claimed compensation for personal injury by accident.

*Report of Insurance Company's Doctor*.—"The body of the testis is normal, but the epididymis is considerably enlarged and knotty in feel; the cord is thickened in its whole extent. Left side slight swelling also. Epididymis tender when touched. He has a discharge (gonorrhœal) which he admits is of eight months' duration, but is now nearly well."

*Conclusions*.—"He had gonorrhœa, but at present is nearly well of it. He has gonorrhœal inflammation of his right epididymis and right spermatic cord, which are now in a characteristically tender and swollen condition, firm to the touch, a post-inflammatory condition. The testicle swelled at the common time after the infection—viz., three months."

NOTE.—The doctor's examination was in October, the discharge had then continued, as the man said, for eight months, and the

accident was alleged to have occurred in May—*i.e.*, three months after the discharge commenced.

## GLANDERS AND OTHER DISEASES INFECTIOUS TO MAN AND ANIMALS.

There are various diseases of animals which are known to infect mankind, of which glanders and anthrax are perhaps the most common. When a person catches one of these diseases from an animal, he may have a right of action for damages against the owner of the diseased animal, or he may be able to prosecute him if his dealings with his beast amount to an offence against the criminal law. The law and cases below are arranged according as they are: (1) Criminal prosecutions; (2) Actions for negligence, private nuisance, or trespass; (3) Actions for breach of contract. The rights under the W.C.A., 1906, of a workman who contracts such diseases are discussed above under Occupation Diseases, p. 32.

Though this section is almost entirely illustrated by cases of spread of infection from animal to animal, yet it is in general upon the same lines that an action would lie if the spread were from animal to man.

An animal suffering from an infectious disease is a dangerous piece of property similar to a biting dog. Before the owner of an infected beast can be convicted on indictment or mulcted in damages, it is necessary to prove "scienter" in the same way as in the case of a biting dog; *i.e.*, it must be proved that the owner knew the animal was infected.

### Criminal Law.

*Public Nuisance.*—By Common Law and by various statutes—Diseases of Animals Act, 1894, consolidating the Contagious Diseases (Animals) Acts, 1878 to 1893—the exposure in a public place of animals infected with certain contagious diseases is a misdemeanour, punishable by penalty.

*Glandered Mare taken to a Fair—Indictable Misdemeanour.*—The indictment averred that the defendant knew that a mare, which he brought to fair, was suffering from glanders, and that such mare was a danger to other animals and to His Majesty's subjects, and that the said mare was a common nuisance.

Held, on motion to arrest judgment: "The defendant was rightly convicted, and it was not necessary specially to aver that the defendant knew that glanders was a disease communicable to mankind."

NOTE.—A footnote to the report refers to an account in the daily press of an entire family becoming infected from a glandered horse and dying.

[Reg. v. Henson, 1 Dears, 24.]

*Exposure in a Public Place of Infected Animal—Ignorance of Existence of Disease.*—The defendant exposed an infected animal, but it was not proved that he knew it was infected.

Held: "Proof of knowledge is necessary to support a conviction."  
[Nichols v. Hall, L.R., 8 C.P., 322.]

*Exposure of Infected Child.*—The mother of a child infected with smallpox was indicted for carrying it about in a public place.

LE BLANC, J.: "There can be no doubt, in point of law, that, if a person unlawfully, injuriously, and with full knowledge of the fact, exposes in a public highway a person infected with a contagious disorder, it is a common nuisance to all subjects, and indictable as such."

[*Rex v. Vantandillo*, 4 M. and S., 73.]

The exposure of an infectious person is now the subject of special public health legislation (*Infectious Disease [Prevention] Act*, 1890).

### Negligence, etc.

*Infection.*—*Vide infra*, Metropolitan Asylums Board *v. Hill*, p. 965.

*Public Nuisance.*—If any man in breach of the criminal law exposes infected animals in a public place, and some individual suffers special and peculiar damage therefrom, the injured party has a right of action for damages.

This action is strictly one of tort; it arises out of the general principle of the law, that any person suffering special and peculiar damage from a public nuisance can recover such damage from the person causing the nuisance. It must therefore be borne in mind that no similar right is imported into an action on contract.

For a discussion on the nature of the special and peculiar damage which will entitle the sufferer to bring an action, see *Winterbottom v. Lord Derby*, L.R., 2 Ex., 316, and *Barber v. Penley* [1893], 2 Ch., 447.

For cases on contract, see below, Contract.

*Keeping of Infectious Animals.*—When infection has in fact been caused to the animals of others by the animals of the defendant which he knows to be infected. (Of course, exactly as in the criminal cases above, "scienter" is a necessary element of the cause of action.)

This law was established by the "Rylands and Fletcher" series of cases (see above, Accident, p. 4; Consequences of Accident, p. 18).

The position was well stated by Bramwell, B. (in the course of the argument of a case which is more fully quoted below), in the following words:

"There is nothing illegal in keeping a mischievous or a diseased animal, provided it is kept safely. In *May v. Burdett* (9 Q.B., 101) the Court said: 'But the conclusion to be drawn from the examination of all the authorities seems to us to be this: that a person keeping a mischievous animal with knowledge of its propensities is bound to keep it secure *at his peril*, and that, if it does mischief, negligence is presumed, without express averment.' May it not be said that an animal having an infectious disease is a 'mischievous' animal? Perhaps it is not correct to say, of a scabby sheep, that it has a 'propensity' to communicate disease, but it has a 'tendency' to communicate it. Is there any distinction in principle between the liability for acts of a mischievous animal and a diseased animal?"

[*Cooke v. Waring*, 2 H. and C., at p. 335.]

*Escape of Animals not known to be Infected; no Negligence proved in their Escape; Action for Damages for Negligence—Scienter.*—The defendant's sheep, which were infected with sheep-scab (though

he did not know it), escaped and entered a neighbour's farm and infected his sheep.

Held: "Not liable, as there was no proof of scienter of the disease or of negligence in allowing them to escape."

POLLOCK, C.B., in holding that the judgment for the defendant was right, said: "I am of opinion that, a scienter being essential to support the action, and there being no evidence of it, my brother Channell was perfectly right in nonsuiting the plaintiff."

BRAMWELL, B. (for his remarks during the argument, see above): "There was no negligence if there was no scienter. . . . There was no evidence that . . . the defendant knew that the sheep were in a diseased condition so as to infer negligence in keeping them."

[*Cooke v. Waring*, 2 H. and C., 332.]

[NOTE.—In this case counsel for defendant, showing cause against the rule nisi for a new trial, admitted that an action for trespass could have been maintained had it been brought, but the action was not in that form.]

*Trespass by Diseased Cattle ; Infection.*—The diseased cattle of the defendant escaped on to the plaintiff's land, and there infected his cattle. The plaintiff sued for trespass, and was held entitled to recover full costs, upon the account of the special damages, since the trespass was aggravated by the damage caused through infection.

[*Anderson v. Buckton*, 1 Str., 192.]

### Contract.

Cases may arise where infection is spread by diseased animals, the property in which is transferred under a contract of sale. Such contracts, for the purposes of our subject, fall under three heads, as follows:

- (i.) Sale without any warranty, express or implied.
- (ii.) Sale with warranty, express or implied, as to soundness.
- (iii.) Sale with express exclusion of all warranties ("sale with all faults").

(i.) *Sale without Warranty, Express or Implied—Infected Horse sold without Warranty.*—The defendant put up for sale by auction at a horse repository a horse which he knew to be glandered. He did not disclose the condition of the horse. The plaintiff bought the horse, and another horse of his caught the disease from the bought horse.

The plaintiff relied on the Contagious Diseases of Animals Acts, 1853, continued by Act of 1856. On demurrer in the Court of Exchequer, it was held that the horse repository was not a "public place" within the Acts, that the damages were too remote, and that in any case no action lay on contract.

BRAMWELL, B.: "How does the damage flow from the act complained of? In truth, it all flows from the plaintiff's buying the horse and dealing with it as he did. . . . His buying it and dealing with it are entirely his own acts, and not the result in any sense, certainly not the natural or necessary result, of any act of the defendant. . . . But it may be said that, though no indictable

offence is shown, yet a sale of a glandered horse by a person knowing it to be so gives a right of action to a buyer ignorant of the defect. In considering this, it is to be borne in mind that no fraud of any sort is to be assumed, no suppression of the marks of the disease or other falsity or concealment; and it is said that, if this were not so, many things with most mischievous defects not apparent might be knowingly sold to innocent purchasers. But in truth the buyer knows of the possible defects, or he does not. If he does, he has no right of complaint if he chose to purchase without a warranty; and if he does not, he ought not to be any better off for his ignorance. In short, the rule of *caveat emptor* as reasonably applies to the sale of a glandered horse as to any other case."

[Hill v. Balls, Court of Exchequer, on demurrer, 2 H. and N., 299.]

It may here be useful to consider the recent case of *Clarke v. Army and Navy Co-operative Society, Ltd.*, 1903, 1 K.B., 155. The facts of the case are briefly as follows: Defendants sold to plaintiffs, without giving any warning, a tin of chlorinated lime, which they knew had a concealed fault likely to injure a person opening it, unless special care were taken. Held that, independently of any warranty, there was cast upon the vendor a duty to warn the purchaser of the danger. (*Vide supra*, p. 941.)

The duty seems to be independent of contract; in Pollock on Torts (8th edit., p. 507): "There is nothing in the reasoning of the Court adverse to the possible existence of such a duty where there is no contract at all."

The case establishes a general principle of law. It is suggested that, by analogy, a vendor selling a diseased beast without warranty, though he would not be liable to the buyer for any damage caused to the beast itself by the disease, yet might possibly be held liable for damage caused to the buyer or to other animals of the buyer. Such a diseased animal is surely an inherently dangerous thing; and if this be so, then the rule in Clarke's case throws on the vendor a duty of disclosure, which cannot, it is submitted, be lifted by the mere absence of warranty; indeed, the duty would possibly still hold good on sale with all faults—at all events, when the fault was so concealed as not to be discernible by an ordinary purchaser and yet was known to the vendor.

(ii.) *Sale with Warranty, Express or Implied.*—The cases above discussed, it must be remembered, are cases in which there was held to be no warranty whatsoever. In the class of case to which we now come, it often happens that a warranty is implied, and these cases must be carefully distinguished from the above cases.

The rights of the injured party on breach of express warranties is part of the general law of contract, and is so clear that it needs no discussion here; but in questions of implied warranty difficulties arise as to whether or not such a warranty is to be implied in a given contract.

There is some conflict in the cases before the Sale of Goods Act, 1893, as to whether, on the sale of an infected animal, a warranty of health is to be implied. Under Section 14 of the Act, however, it is

probable that damages could be recovered if an animal sold under the warranties implied by the section were diseased.

A short note on the law of Sale of Goods is given on p. 6.

*Sale of Infected Animal in Public Place; Implied Warranty.*—An infected cow was put up for sale in a market. The plaintiff bought it, and it infected the animals on his farm.

On appeal from a County Court, the Court held that there was no evidence of “scienter” to go to the jury, and judgment was entered for the defendant. In the course of the argument and judgment, however, the Judges seemed to hold that, had “scienter” been proved, the defendant would have been liable, in spite of *Hill v. Balls* (*supra*, p. 952). They distinguished that case on the ground that the sale there was not in a public place, whereas in the case before them it was.

BLACKBURN, J. (*obiter*): “The defendant, by taking a cow to a public market to be sold, though he does not warrant her to be sound, yet thereby furnishes evidence of a representation that, so far as his knowledge goes, the animal is not suffering from any infectious disease.”

[*Bodger v. Nicholls*, 28 L.T., 441.]

The above case was commented upon by Earl Cairns, L.C., in the case of *Ward v. Hobbs*, 4 App. Cas., at p. 22, in the following words:

“I desire here to be held free from expressing any opinion as to what, in a case in which, there being no negation of warranty, no statement such as I have read from the two conditions of sale in this case, ought to be the law as to a man who sent his pigs to a public market knowing them at the time to be tainted with disease. I observe that in a case in the Court of Queen’s Bench, *Bodger v. Nicholls*—coming on appeal, I think, from a decision of a County Court Judge—my noble and learned friend Lord Blackburn . . . seems to have thrown out an opinion that in a case of that kind, there being nothing upon one side in the shape of statement or negation, and there being simply the fact of a man sending diseased animals to a public market to be sold, there must be held to be a representation by conduct that the animals were free from disease, and that the person so sending them might be liable for the consequences of that representation if it turned out to be untrue. My lords, I repeat that I desire, so far as I am concerned, to hold myself unpledged if such a case had to be considered.”

(iii.) *Express Exclusion of All Warranties—Infectious Animals—Sale with All Faults.*—Pigs, the property of the defendant, were sent by him to a public market when, to his knowledge, they were suffering from pig typhoid. By this he committed a breach of the Contagious Diseases (Animals) Act, 1869. The pigs were sold by an auctioneer, whose catalogue contained the words: “No warranty will be given . . . and . . . no compensation shall be made in respect of any fault or error of description of any lot in the catalogue.”

EARL CAIRNS, L.C., at p. 23:

“There was here a breach of a statutory duty. . . . What



occurred in the public place was the buying and the selling and no tainting of other animals."

LORD O'HAGAN, at p. 25:

"The statement of claim relies upon a warranty, but makes no case of deceit or fraud, or failure of consideration, and contains no averment that the plaintiff was misled by any statement of the defendant. Warranty there was none, but, on the contrary, the conditions of sale expressly declined the giving of any."

The noble and learned lord then quoted the following passages from Story on Contract:

"The general rule, both of law and equity, in respect to concealment, is that mere silence with regard to a material fact, which there is no legal obligation to divulge, will not avoid a contract, although it may operate as an injury to the party from whom it is concealed. . . . Although a vendor is bound to employ no artifice or disguise for the purpose of concealing defects in the article sold, since that would amount to a positive fraud on the vendee, yet, under the general doctrine of *caveat emptor*, he is not ordinarily bound to disclose every defect of which he may be cognizant, although his silence may operate virtually to deceive the vendee."

He then cited, with approval, the passage from the judgment of Lord Ellenborough, C.J., in *Bagehole v. Walters*, which is given below.

LORD SELBORNE, at p. 29:

"The argument which for some time weighed with me was, that for a man to sell to another, without disclosing the fact, an article which he knows to be positively noxious, and which the other man does not know to be so (even though he expressly negatives a warranty, and says that the purchaser must take his bargain with all his faults), is an actionable wrong. I confess I should not be sorry if the law were so, but I know no authority for the proposition that such is the law, even with respect to the particular case of infectious disease in animals sold."

Judgment for the defendant affirmed.

[*Ward v. Hobbs*, 4 App. Cas., 13.]

The passage cited by Lord O'Hagan is as follows:

"Where an article is sold *with all faults*, I think it is quite immaterial how many belonged to it within the knowledge of the seller, unless he used some artifice to disguise them, and to prevent their being discovered by the purchaser. The very object of introducing such a stipulation is to put the purchaser on his guard, and to throw upon him the burthen of examining all faults, both secret and apparent. I may be possessed of a horse I know to have many faults, and I wish to get rid of him for whatever sum he will fetch. I desire my servant to dispose of him, and, instead of giving a warranty of soundness, to sell him *with all faults*. Having thus laboriously freed myself from responsibility, am I to be liable if it be afterwards discovered that the horse was unsound?" (Judgment of Lord Ellenborough, C.J., in *Bagehole v. Walters*, 3 Camp., 154, at p. 156.)

The discussion of Clarke's case (*supra*, p. 953), under Section i., seems to be equally relevant under this section.

## HEART.

Heart disease in the young adult is usually either congenital—*i.e.*, the sufferer is born with it—or it arises after rheumatism, chorea, rheumatic fever, or some disease resembling these. In old age, incompetence of the valves caused by a degenerative change (atheroma) is common. Actual heart injury caused by accident to a healthy heart is very rare. The dilatation of one side of the great artery (aorta), producing what is known as an “aneurism,” is not an uncommon consequence of long-continued strains acting upon a weak-walled artery. An accident might cause the aneurism to rupture, or it might rupture without any special strain; the man would die in either case, and the death might be held to be due to an accident. (For Aneurism, see Vessels.)

Injuries to the heart may be classified as follows :

1. Injuries to the healthy heart.
2. Injuries to the diseased heart.
3. Heart disease, independent of, but occurring after, an injury.

## 1. INJURY TO THE HEALTHY HEART.

## Insurance.

The policy provided : “ This insurance does not cover . . . injuries, or death resulting therefrom, of which injuries there are no visible external marks upon the body (the body itself not being considered such mark) produced at the time of and by the accident.”

*Heart strained* (Insurance).—On March 24, 1902, the deceased man strained his heart in reaching down to lift a heavy bar which was placed below the level of his feet. He, however, picked up the end of the bar, and carried it to an anvil, where he laid it down, and immediately complained of being sick. He turned pale, trembled, grew cold, perspired freely, and had to leave work. He went home, and called in a physician, who pronounced the trouble a violent dilatation of the heart, causing hypertrophy (*sic*), of which he died on April 18, 1902.

Held : “ The death is one covered by the words of the policy.”

[*Horsfall v. Pacific Mutual Insurance Company*, 98 Am. St. Rep., 846.]

NOTE.—In reference to the judgment in this case, when delivering his judgment in *Scarr v. The General Accident Assurance Company* (below), Judge Bray stated :

“ This, I think, may be justified by the fact that injury to the heart was not in his case the natural consequence of lifting the weight, but of the unintentional exertion which his position made necessary.”

*Acute Dilatation* (Insurance).—The words of the policy were : “ Any fatal injury caused by violent, accidental, external, and visible means.”

On December 26, 1903, the deceased man, in attempting to eject

a drunken man from his master's premises, strained his heart, which was already in a weak condition. The strain was followed by dilatation, and he died on January 25, 1904.

BRAY, J.: "Now, were the means which caused the bodily injury under the above circumstances accidental? This is a question of some difficulty, but my difficulty has certainly been lessened by the very clear arguments that were addressed to me by the counsel on each side. It seems to me that there was nothing accidental in the pushing and pulling of the drunken man, or the exercise of physical exertion in so doing. Scarr intended to do this. The drunken man offered only passive resistance. There was no blow. Then, was the effect on the heart accidental? The demand or strain on the heart was the natural and direct consequence of the physical exertion, which I have necessarily assumed to be violent physical exertion. . . . Here, as I have said, Scarr intended to violently exert himself, and the injury to the heart followed as the natural consequence. He never got into any position which he did not intend. It seems to me very like the case of a man with a weak heart injuring it by running to catch a train. He intends to run. Nobody would call such an event an accident. No one would describe him as meeting with an accident."

Held: "Not an injury caused by accidental means."

[Scarr v. General Accident Assurance Corporation, 1905, 1 K.B., 393.]

### Negligence.

*Heart (Cow's) Injury by swallowing Iron Wire—Negligence.*—Firth's cow picked up and swallowed some pieces of iron wire, one of which eventually worked its way to the pericardium, and caused death.

The pieces of iron wire were part of an old fence which had become rotten and shed fragments into Firth's field, where they lay among the grass. The duty to fence was on the defendants.

LINDLEY, J.: ". . . That parts of it should fall on the plaintiff's land was a natural result of the decay of the wire, and the pieces, being hidden in the grass, were naturally liable to be swallowed by the cattle grazing there. The defendants, therefore, seem to us to be answerable for the injury to the plaintiff's cow, which was caused by the natural result of their acts."

[Firth v. The Bowling Iron Company, on appeal to Divisional Court. Lindley and Grove, JJ., 1878, 3 C.P.D. 254; 47 L.J.C.P., 385.]

### Workman's Compensation.

*Heart, Gradual Strain—Not an Accident (W.C.A., Scottish).*—A workman was engaged in hauling heavy hutches by hand up a steep gradient. He felt a sudden pain in his chest, and fell down, saying he thought he had "jerked" himself. A few days afterwards he became totally incapacitated. The arbitrator, with the assistance of a medical assessor, found as a fact that the cause of the applicant's incapacity for work was cardiac breakdown, due to the fact that the work in which he had for some days been engaged was too heavy for him. He was not injured by any sudden jerk; but the repeated excessive exertion strained his heart unduly, until finally it was overstrained, and this caused the pain which made him let the hutch go.

On appeal, the Lord President said that it was a "case of great delicacy and difficulty, because it was one of those cases . . . where one seems almost driven by the course of decisions each of which gradually goes a little farther than the one which preceded it, until at last you reach a point which, when the first decision was given, was probably not contemplated. . . . The view which the doctor seemed to have taken was that it was really not the effect of the occurrence at all, but, if I may use the expression, that the man was simply overtired by overexertion. . . . The only thing the Court could do was to affirm the decision of the Sheriff Substitute."

[*Coe v. The Fife Coal Company*, 1909, 46 S.L.R., 325; 2 B.W.C.C., 8.]

*Sudden Death: Fall from Driver's Seat of Omnibus; Heart Failure—Not an Accident* (W.C.A.).—The following are the actual words of the Judge's notes of the case:

"The deceased man Thackway was employed by the respondents to drive their bus. On April 13 he drove his bus up to the station, and backed it against the curb. Two men, Heriott and Stiles, were talking together, when they heard something fall. They went to look, and found Thackway had fallen on the right-hand side of his bus, and was lying on the ground on his back. He was bleeding 'a lot' from a wound on the right side of his forehead, and the bleeding continued for a quarter of an hour. He was unable to speak, but his eyes and lips moved for a short time after his fall and before death. He was put on an ambulance and taken to the General Hospital. There Dr. Grey, the House Surgeon at the hospital, made a post-mortem examination.

"It was not disputed that Thackway's heart was much enlarged, and weighed 17 or 18 ounces instead of the normal 9 or 10 ounces. Dr. Grey gave evidence at the inquest that was held. In his evidence in this case he said there was nothing in the injuries to the skull to cause death, but that the state of the heart would cause death. He had no doubt that death was due to a sudden fatal heart attack. The body was taken from the hospital for burial, but after it was taken from the hospital and before burial, another post-mortem examination was made by Dr. Dickinson on behalf of the applicant.

"There being no direct evidence whatever as to whether the deceased fell after and in consequence of a sudden fatal heart attack, or whether he died in consequence of a fall and from a fatal attack of concussion of the brain, as Dr. Dickinson says, the case had to be decided on the medical evidence alone. It could not be referred to a medical referee, as both the medical referees from this district gave evidence in the case—namely, Dr. Dickinson and Dr. Chapman—and their evidence was as contradictory as evidence can well be. It was not only contradictory on the main question, but also on the question as to the possibility of continued bleeding for a short time after a fatal attack of the heart. I only observe further, on the evidence, that while Dr. Grey and Dr. Chapman were both clear that death was due to a sudden fatal heart attack, just as Dr. Dickinson was clear it was due to concussion of the brain, yet Dr. Hart Smith, who was called for the applicant, was by no means so clear as Dr. Dickinson, and admitted there was no injury to the skull which would

account for death, and that it was not impossible that death might be due to a stoppage of the mitral valve (*sic*).

“The conclusion I came to upon the evidence was that it was more probable that death was caused by a sudden fatal heart attack than that it was caused by an accidental fall aggravated by the state of the heart.”

[*Thackway v. Connelly*, 1909, 3 B.W.C.C., 37.]

## 2. INJURY TO THE DISEASED HEART.

*Valvular Disease, probably accentuated by Accident* (W.C.A., Scottish).—The applicant was at work on October 25, and when “endeavouring to replace a derailed hutch he so exerted himself by a sudden jerk that injury was caused to his heart or aorta, causing a serious affection of the valve of the heart” (aortic valves?).

The immediate effect on the appellant was faintness and weakness, but he managed to walk home. The workman’s heart system was probably not in a perfect condition at the time of the accident, although he was himself unaware of it. He remained at home three days, and then returned to light work till November 15; he then had a period of rest and light work on and off till October, 1902, when he continued regularly at light work.

Held: “An accident.”

[*Rankin v. The Alloa Coal Company*, 1904, 6 F., 375.]

*Heart Disease pre-existing and aggravated* (W.C.A.).—A sewer-man contracted enteritis while working in the L.C.C. sewers. The enteritis affected his heart, which was already diseased.

COZENS-HARDY, M.R.: “The argument for the appellant, when traced to the very bottom, would undoubtedly mean holding that every man who in the course of and arising out of his employment contracts a disease is entitled to compensation under the Act.”

Held: “The contracting of enteritis in this manner was not an injury by accident.” The result of the contracting of this enteritis was held to have accelerated a long-standing heart disease, and to have incapacitated the man from work before the time at which such heart disease would otherwise have incapacitated him. But, as the contracting of the enteritis was not an accident, the accelerating of the heart disease was not the consequence of an accident.

[*Broderick v. The L.C.C.*, 1908, 2 K.B., 807; 24 T.L.R., 822; 1 B.W.C.C., 219.]

## 3. HEART DISEASE, INDEPENDENT OF, BUT OCCURRING AFTER, AN INJURY.

*Heart Disease supervening during Incapacity* (W.C.A., Scottish).—A workman while incapacitated by accident was attacked by heart disease, which in itself was held by the arbitrator (Sheriff) to render him incapable of working, and so he ended the compensation. This was reversed by the Scottish Appellate Court.

“It was quite competent for the employer to prove, if he could, that the original cause of the disability had ceased, and that a new cause had supervened; and if he had succeeded in proving that, the Sheriff (arbitrator) would have been warranted in declaring the

compensation ended. Now, the finding of the Sheriff is that a sufficient cause of disability has supervened—namely, a cardiac affection—and that this ‘was not proved to be in any way connected’ with the original injuries; in other words, that it may or may not be so connected. I think it rests on the employer to prove—(1) that the supervenient cause was not connected with the original injuries; (2) that the original injuries have ceased to operate as an effective cause of incapacity.”—LORD M’LAREN.

[*Quinn v. M’Callum*, 1909, 46 S.L.R. 141; 2 B.W.C.C., 339.]

## HEAT.

(FOR ELECTRICAL BURNS, SEE ELECTRICITY.)

Heat produces two effects: (1) Burns; (2) heatstroke.

## BURNS.

### Negligence.

*Scald, Right Arm and Body, and Lower Jaw broken—Negligence (Damages).*—The plaintiff, a table-waiter on board s.s. *Montreal*, earning about \$50 a month, was about to take a cup of tea out of an urn, when it exploded and he received the above injuries. In consequence he suffered from “total inability to work and acute suffering during three months, bodily disfigurement, diminished sense of hearing, and permanent impairment of physical strength.”

Damages \$6,000, which were held “not to be so grossly excessive that it should be set aside.”

[*Richelieu and Ontario Nav. Company v. Dorman*, Q.R., 16 K.B., 375.]

*Fire; Railway-Engine run under Statutory Powers—Negligence.*—[This is not a case of personal injury, but is quoted here to illustrate the principles mentioned on p. 4.] Vaughan owned eight acres of a wood, which was set on fire through a spark from an engine of the defendants. The defendants had statutory permission to run engines, and had taken every precaution suggested by science to prevent injury.

COCKBURN, C.J.: “When the Legislature has sanctioned the use of a particular means for a given purpose, it appears to me that that sanction carries with it this consequence, that the use of the means itself for that purpose (provided every precaution which the nature of the case suggests has been observed) is not an act for which an action lies independent of negligence. . . .”

CROMPTON, J.: “Upon the case submitted to us, it is to be taken as a fact that the defendants took all the precautions that they could consistent with the working of the line.”

Held: “They had a right to run the engine, and as they did not use it negligently they were not liable.”

[*Vaughan v. Taff Vale Railway Company*, 1860, Exchequer Chamber, Cockburn, C.J., Williams, J., Crompton, J., Mills, J., Byles, J., and Blackburn, J., 5 H. and N., 679; 29 L.T., Ex. 247.]

### Contract.

*Burn—Damages* (Sale of Goods Act, Section 14).—A rubber hot-water bottle burst on fifth day of use and scalded the wife of the purchaser. An analysis showed that it consisted of 56·6 per cent. pigments, 14·6 per cent. oil substitutes, 25·8 per cent. solids, very little being pure rubber.

Held: "There was an implied warranty that it was fit for its purpose, and defendant was liable because it was not fit."

[*Preist v. Last*, 1903, 2 K.B., 148.]

### Workmen's Compensation Act.

*Burn—Death* (W.C.A., Irish).—A girl was engaged in attending to a child, while at the same time drying her hair near a fire. She caught fire, and two-thirds of the skin of her body were burned; she died afterwards of septicæmia. "Her sleeve was loose; she caught fire while drying her hair."

FITZGIBBON, L.J., held: "The risk of taking fire while engaged in drying her hair was not one within the scope of her employment."

Held: "The accident did not arise *out of* her employment."

[*Clifford v. Joy*, 43 I.L.T.R., 193.]

*Death* (W.C.A.).—Helping aged fellow-servant from bedroom of master, which they both shared, was held to be part of the duty of the deceased, and so the fatal burning was "a personal injury by accident arising out of and in the course of the employment."

[*Chitty v. Nelson*, Stockton-on-Tees C.C., Judge Templar, 1909, *Post Magazine*, lxx. 79.]

*Left Hand and Left Leg—Incapacity* (W.C.A., Scottish).—A workman was severely burned by a naphtha-lamp falling upon him on September 5, 1905, and on January 23 claimed to be still incapacitated (four and a half months).

[*Gourlay Brothers v. Sweeney*, 1906, S.C., 965.]

### HEATSTROKE.

*Heatstroke in a Man of Low Vitality* (W.C.A.).—A trimmer who was starving was employed on the s.s. *Majestic* to work in the stokehole, and, while raking out the ashes that had fallen from the furnace, fell down in a state of collapse as a result of an attack of heatstroke.

LORD MACNAGHTEN said: "In the case of a man not physically unfit, who knows what to do when he feels an attack coming on, the illness seldom if ever leads to any serious consequences. Though the attack is developed rapidly, the symptoms are sufficiently clear and sufficiently gradual to give a sufficient warning in time to enable him to obtain relief by going on deck for fresh air. The evidence was that the conditions were normal, the ventilation in perfect order, and the heat where the man was standing not more than 96 degrees."

THE LORD CHANCELLOR: "To my mind, the weakness of the deceased which predisposed to this form of attack is immaterial. The fact that the man who has died from a heatstroke was by

physical debility more likely than others so to suffer can have nothing to do with the question whether what befell him is to be regarded as an accident or not."

LORD ASHBOURNE quoted Lord M'Laren in *Stewart v. Wilson and Clyde Coal Company*.\* "Although the heatstroke may be called a disease, it is in this case, in my opinion, a disease directly caused by an accident, arising out of or in the course of his weak state of health. Its not being scheduled as an industrial disease in the Workmen's Compensation Act, 1906, does not affect the question, for the Act expressly provides (Section 8 [10]) that 'nothing in this section affects the right of a workman to recover compensation in respect of a disease to which this section does not apply, if the disease is a personal injury by accident within the meaning of this Act.' I do not at all say that all diseases arising out of or in the course of an employment should be regarded as a personal injury by accident, but I am of opinion that under the circumstances of this case and its effects Williamson was killed by a personal injury by accident."

[*Isma, Imrie and Co. v. Williamson*, 1908, A.C., 437; 1 B.W.C.C., 232.]

*Heat Apoplexy* (W.C.A.).—The applicant was the widow of a ship's fireman. The deceased on the day of his death had declared that the work was killing him, and was subsequently found unconscious on the hot ashes in front of the furnace. The Judge held that it was an accident, and awarded £245 15s. as compensation.

[*Hunt v. J. and C. Harrison*, West Hartlepool C.C., *Policy Holder*, vol. xxvi. 324.]

*Heat Apoplexy—Cerebral Hæmorrhage—Drinking Excessive Quantity of Water* (W.C.A.).—A fireman of a ship was working in a stokehole, where he was noticed to be drinking great quantities of water. Soon after he was found unconscious, but with the left side of his mouth drawn and twitching. He died without recovering consciousness. On the arrival of a ship an inquest was held. Dr. Bird gave evidence that there was no mark of violence upon the body, and that, without a post-mortem, he could not give a definite opinion as to the cause of death, but that, judging from the evidence, he thought that the man had died from cerebral hæmorrhage and syncope. The coroner did not order a post-mortem, and the jury found that death was due to natural causes—namely, hæmorrhage of the brain.

Arbitration proceedings were commenced by the dependants, and the following medical evidence was given:

William Whitford, M.D., M.Ch., said that, assuming the accuracy of the description that the mouth was twisted, he should say death was due to cerebral hæmorrhage, due to the excessive heat and the constant drinking of so much water distending the vessels of the brain.

"The drinking of the water might cause it apart from heat. I can conceive such a case—drinking 4 to 6 pints. Cerebral hæmorrhage is caused by the rupture of an artery. This is more so with the heat. The heat itself might distend. The drinking of the water extends the pressure and thins the wall. This is more likely to

\* See below, Muscles.



happen if the artery is diseased or weak. I think this case is mainly due to the quantities of water drunk, coupled with the heat. I can conceive it even without the heat.

"The drinking of cold water might have an effect upon the action of the heart. If the man had a weak heart, the drinking of the cold water might cause syncope, and if it were not for the observation that the mouth was drawn to one side, I would have doubt whether it was syncope or cerebral hæmorrhage. I would agree with Dr. Bird, were it not for the evidence that the mouth was pulled to one side. This, I think, points to cerebral hæmorrhage, and makes me think it was cerebral hæmorrhage.

"I have no practical doubt in my mind that this case was due to the combined effect of heat and the drinking of the water. I think the amount of water this man drunk shows that there was heat."

The defence called Dr. Glynn, who gave the following evidence :

"Death may follow from cerebral hæmorrhage under many circumstances. A person may be sleeping in bed. I don't think that heat would increase the tendency which, although it produces flushing and redness of the surface, by producing this external congestion it diminishes the pressure on the interior vessel. Heatstroke brings about syncope if fatal. That is quite different to the symptoms described in this case. I don't think that drinking the water would increase the tendency to cerebral hæmorrhage. If he drank more than he sweated, it might be dangerous. Without a post-mortem it is very difficult."

In the course of his cross-examination he said :

"I don't think the heat of the furnace, coupled with the drinking of the water, had anything to do with the cerebral hæmorrhage in this case."

His Honour found, as a fact, that the deceased died from cerebral hæmorrhage brought on by the conditions of his work, his exposure to heat, and the drinking of water, and that but for his work he would not have died when he did, and awarded compensation. The award, being one of fact, was upheld by the Court of Appeal.

[*Johnson v. The Owners of the Ship Torrington*, 3 B.W.C.C., 68.]

## INFECTION AND BLOOD-POISONING.

Strictly speaking, all diseased conditions caused by bacteria are "infections" and "blood-poisoning," for they are all cases of poisoning of the blood by bacteria or their products. Among these diseases are anthrax, diphtheria, glanders, pyæmia, sapræmia, septicæmia, septic pneumonia, tetanus, typhoid fever. Many cases of infection will be found either in the section on the part affected (*e.g.*, typhoid under Intestines, septic pneumonia under Lungs), or in the section on the disease (*e.g.*, Anthrax, Tetanus, etc). Under this section on Infection we chiefly restrict the subjects to those cases of infection that are popularly known as "blood-poisoning," such as pyæmia, septicæmia, septic intoxication, and erysipelas; but a few cases illustrating of the law of infection are also included.

Cases of infection from animals and men are also discussed under the section on Glanders.

A man gets a wound, and blood-poisoning causes his death. The conclusion is that the injury caused the blood-poisoning and the death. To the doctor's mind, however, this is not so simple. A man gets a wound, and microbes are developed in it, causing death from blood-poisoning. The microbes may have been, as millions of microbes are, already on the skin or clothes of the man, or on the weapon causing the injury; or they may already have been circulating in his body and deposited in a spot weakened by an injury; or they may have been introduced into the wound itself even weeks after the accident. Legally, it may often be essential to ascertain the moment of advent of microbes into a wound; for this, the determining factor is the exact date at which the symptoms of blood-poisoning first appear, for after microbes once settle in the wound, they take a certain time to develop, which time is known as the "incubation period." This period is fairly constant, or, at all events, is constant within clearly defined limits for each microbe. For instance, a man who develops erysipelas three days after a wound was probably infected at the time of the injury, whereas a man who develops it for the first time a fortnight after the injury is practically certain not to have been infected at the time of the injury, but some time afterwards. (See below, *Dunham v. Clare*, W.C.A.)

With regard to the liability for spreading infectious disease, the law varies according to whether he be a public or private individual. Public authorities, though liable for the negligent performance of their duties, are now possessed of very wide powers to isolate, remove, collect, and subsequently disinfect infectious persons.

The law will be found in books on public health, but such cases as the *Metropolitan Asylums District v. Hill* 1881, 6 App. Cas., 193; *Bendelow v. The Guardians of Wortley Union*, 36 W.R., 168; *Withington Board of Health v. The Corporation of Manchester* 1893, 2 Ch., 190; and the *Attorney-General v. The Corporation of Manchester* 1893, 2 Ch., 87, may be consulted to show the prospects of success in such an action.

### Insurance.

*Infection: Erysipelas* (Insurance).—Words of policy: "All forms of cuts when accidentally occurring from material and external causes operating . . . where such accidental injury is the direct and sole cause of death; but it does not insure against death from . . . erysipelas or any other disease arising before, or at the time of, or following, such accidental injury."

The insured cut his foot, erysipelas set in, and he died.

Held: "The insurance company was protected by the above condition."

CLEASY, B.: "When an accident happens to anyone, causing bodily injury, a variety of diseases may supervene, as to which it may be difficult to say whether death is caused by the disease or by the injury."

KELLY, C.B., dissented.

[*Smith v. Accident Insurance Company*, L.R., 5 Ex., 302.]

*Infection: Erysipelas; Septic Pneumonia* (Insurance).—For a case where a small wound subsequently led to erysipelas and septic pneumonia, see below, Lungs.

## Criminal Law.

*Vide supra*, Glanders, p. 950.

## Negligence.

*Infection.*—Private individuals who take reasonable precautions to prevent spread of infection, and who also fulfil all their statutory obligations—*i.e.*, who are not guilty of negligence—would probably not be liable for the spread of infection; for though the law has since provided for dealing with many of the very difficulties suggested by Lord Blackburn, yet his *obiter dictum* in the Metropolitan Asylums District *v.* Hill expresses the law on the subject generally.

BLACKBURN, J.: “Where those who have the custody of the person sick of an infectious disorder have not the means of isolating him from the other inmates, which is very common with the poor, and consequently those other inmates and the neighbours are exposed to the risk of infection, I think the inability to isolate him would form a sufficient excuse to be a defence to any indictment; and I think, also, though I am not aware of any authority on the subject, that the neighbours could not maintain any action for the damage which they would in such a case sustain from the proximity of the infected person, it being a necessary incident to the use of property for habitation in towns that contagious sickness may befall their neighbours.”

. *Sewage contaminates Percolating Water*—*Negligence.*—[This case illustrates the principles as to infection of well-water, and, had illness resulted, it would have made part of the claim for damages larger.]

Tomlinson’s land was higher than Ballard’s, and in consequence water percolated from his land down into the land and well of Ballard.

Tomlinson converted his well into a cesspool for sewage, and the mixed sewage and water percolated down into Ballard’s well and contaminated his water.

BRETT, M.R.: “The shaft of that well is an artificial thing, and the defendant therefore collected a quantity of sewage into an artificial reservoir. . . . No one has at any time any property in water percolating below the surface of the earth, even when it is under his own land, but it is equally clear that everybody has a right to appropriate that percolating water—at least, while it is under his own land—to the extent that he may take it all so as to prevent any of it going on the land of his neighbour. . . . This percolating water below the surface of the earth is therefore a common reservoir or source in which nobody has any property, but of which everybody has, as far as he can, the right of appropriating the whole. . . . To appropriate it in its natural state, and no one of those who have a right to appropriate it has a right to contaminate that source. . . .”

COTTON, L.J.: “. . . They, the defendants, are not taking the water, but they are putting upon their land filth which gets down into the underground water in the water-bearing stratum, which is partly under that of their neighbour. They are therefore in no way

exercising their right which a person who draws the water under his own land is exercising. . . .”

LINDLEY, L.J.: “The right to foul water is not the same as the right to get it, and, in my opinion, does not depend on the same principles. *Prima facie*, every man has a right to get from his own land water which is naturally found there, but it frequently happens that he cannot do this without diminishing his neighbour’s supply. In such a case the neighbour must submit to the inconvenience. But, *prima facie*, no man has a right to use his own land in such a way as to be a nuisance to his neighbour, and whether the nuisance is affected by sending filth on to his neighbour’s land, or by putting poisonous matter on his own land, and allowing it to escape on to his neighbour’s land, or whether the nuisance is affected by poisoning the air which his neighbour breathes, or the water which he drinks, appears to me wholly immaterial.”

This was a case on appeal from Pearson, J., who held that, as the plaintiff had no property in the underground water which came from the defendant’s land, he had no cause of action against the defendant for polluting such water.

[Ballard v. Tomlinson, C. A. Brett, M.R., Cotton and Lindley, L.JJ., 1885, 29 C.D., 115.]

*Vide infra*, Wounds, Rylands v. Fletcher, p. 1080; and Nichols v. Marsland, p. 1086.

*Scarlet Fever; Public Authority—Negligence.*—The plaintiff’s small son caught scarlet fever, was removed to an isolation hospital of the Corporation of Liverpool, and afterwards detained in a convalescent home till the doctor thought him cured. He was then sent home, and the other children promptly caught scarlet fever. The father brought an action against the Corporation for £55 damages, being the expenses due to the infection thus spread.

He claimed that there was a want of reasonable skill or care on the part of the Corporation’s doctor in or about the discharge of the boy;

That in consequence of such want of skill or care, the plaintiff suffered the damage complained of;

And that there was an undertaking by the defendants with the plaintiff that their visiting surgeon should act with reasonable care and skill in and about the discharge of the boy from the hospital.

Held: “That the plaintiff was not entitled to recover, for the legal obligation of the defendants extended only to the provision of reasonably skilled and competent medical attendance for the patients, which obligation they had discharged, and that there was no absolute undertaking or obligation on their part that no patient should be discharged by the visiting physician while still in a condition which might cause infection.”

[Evans v. Liverpool Corporation 1906, 1 K.B., 160.]

*Infection; Diphtheria; Spread from Isolation Hospital—Negligence.* An isolation hospital was erected on land adjoining the plaintiff’s land, and separated therefrom by a wire fence. His daughter caught diphtheria and died. Four days before developing symptoms she had crawled under the wire fence and approached the hospital, and had also played with a kitten which had lived there.

Medical evidence was called to show that the infection of diph-

theria bacilli might be brought about by the children coughing on the grass where the deceased child had played.

Held: "This evidence was not enough to go to the jury, as the infection might be spread in many different ways, and there was nothing to show the child had, in fact, contracted her illness in the way suggested."

[*Sherwell v. Alton U.D.C., Ridley, J., and jury, 1909, 25 T.L.R., 417.*]

*Diphtheria; Negligence—Vide infra, Throat, p. 1071.*

### Contract.

*House Let; Drains Defective; Expressed Warranty Precedent upon taking the Lease.*—The plaintiff, who had previously suffered from the effects of bad drainage, agreed to take a lease of the defendant's house for three years, but he asked the defendant if the drains were in good order, and declined to complete until he had his assurance that they were.

The defendant stated, which was a fact, that they had all recently been put in good order. The plaintiff insisted on a further statement, and suggested a sanitary certificate; but the defendant answered that it was quite unnecessary, as the drains were in a perfect condition, and said, "I give you my word on the subject."

There was no fraudulent misrepresentation on the defendant's part, and he did not know that in fact the drains were out of order; but it was held he was liable for the costs of putting these right, and for the illness caused by the drains, and the plaintiff was awarded £75 damages. The liability was based on the breach of a verbal warranty, collateral to the lease.

The defence was that there was no warranty, but only a representation.

A. L. SMITH, M.R.: ". . . Now, what constitutes a warranty in law, or a mere representation? To create a warranty, no special form of words is necessary. It must be a collateral undertaking forming part of the contract by agreement of the parties expressed or implied, and must be given during the course of the dealing which leads to the bargain, and should then enter into the bargain as part of it. It was laid down by Buller, J., as long ago as 1789 in *Pasley v. Freeman* (1), 'it was rightly held by Holt, C.J.,' in *Cross v. Gardner* (2), and *Medina v. Stoughton* (3), and has been uniformly adopted ever since, that an affirmation at the time of sale is a warranty provided it appear on evidence to have been so intended. In determining whether it was so intended, a decisive test is whether the vendor assumes to assert a fact of which the buyer is ignorant, or merely states an opinion or judgment upon a matter of which the vendor has no special knowledge, and on which the buyer may be expected also to have an opinion and to exercise his judgment. In the former case it is a warranty, in the latter not (see Benjamin on Sales, third edition, p. 607, whose statement upon the law, in my judgment, is accurate)."

Held: "There was a warranty collateral to the lease."

[*De Lassalle v. Guildford C.A., A. L. Smith, M.R., Collins and Romer, L.JJ., 1901, 2 K.B., 215.*]

*House Let; Warranty that it was in a Sanitary Condition (Expressed Warranty).*—The defendant, Mr. Harrison, refused to pay the rent or to remain in a house which had been expressly warranted to be in a sanitary condition by a Mr. Webb, the agent of the plaintiff, the landlord. There was no contract in writing. The plaintiff's agent, who gave the warranty, did not know that the house was insanitary.

LORD ESHER, M.R.: “. . . There was no colour or pretence for saying that Mr. Webb stated what he knew to be false. The learned Judge did not find it as a fact, and there was no ground for alleging it. The contract here was not in writing, and it was made by the plaintiff's agent, so that it bound the plaintiff.

“When a statement was made at the time of a verbal contract, and for the purposes of the contract, that statement must be taken to be part of the contract. Therefore, what Mr. Webb said here was part of the contract. He stated that the house was in a perfectly sanitary condition. Not only, therefore, was there a warranty, ordinarily so called, but also a warranty which went to the whole root and condition of the contract. It was a condition. There was, therefore, a condition and a warranty. . . . The condition upon which the defendant was to take the house was broken, and she was not bound to pay the rent, as she did not take the house, but left in a reasonable time.”

[*Bunn v. Harrison*, on appeal, Lord Esher, M.R., Lindley and Lopes, L.J., 1886, 3 T.L.R., 146.]

*House Let, Furnished; Implied Contract of Fitness; Infected with Measles (Contract).*—The defendant agreed with the plaintiff to take his furnished house from March 28 at a rent of fourteen guineas a week. The defendant then refused to take the house and pay the rent, as the house was infected by measles at the time.

A child had had measles in the house till March 19, but was then removed and the house disinfected; but this was insufficient, and the house was found as a fact to be still infectious on March 28.

FIELD, J., referred to the cases of *Smith v. Marable* (11 M. and W., 5; 12 L.J.Ex., 223), and *Wilson v. Finch Hatton* (L.R., 2; Ex. D., 336), and said that, according to these cases, the question he should ask a jury, and which he must therefore ask himself, was: Was the house in a good and tenantable condition, and reasonably fit for human occupation from the very day on which the tenancy is dated to begin? Unless these conditions were fulfilled, the defendant was not bound to take the house, and in his opinion they were not fulfilled.

Judgment for the defendant.

[*Bird v. Lord Greville*, 1 Cab. and Ell., 317.]

*House Let, Furnished, for Short Period; Implied Warranty.*—A lady hired a house in Wilton Crescent, London, for three months from May 7, 1875, in the height of the season, intending to occupy it immediately.

There was a written agreement in which there was no mention of the drains. There had been some verbal discussion about the drains, which the agent “believed to be in perfect order,” but no reliance appears to have been placed on this at the hearing of the case. On May 9 the tenant's horses and luggage arrived, when she found the

whole place smelt of drainage, and at once left. The inspector of nuisances discovered cesspools overflowing under the flooring, etc. This was all rectified by May 25, but the tenant refused to return.

Held: "Upholding the Court below, that the state of the house at the beginning of the intended tenancy entitled the tenant to rescind the contract and to refuse to pay any rent for use and occupation."

[*Wilson v. Finch Hatton*, Court of Exchequer, on appeal from Quain, J., C.A., Kelly, C.B., Pollock, B., Huddleston, B., 1877, 2 Ex. Div., 336.]

*House Let, partly Furnished; Water ran Dry after the House had been Occupied for Three Months.*—A house was let with a warranty that it had good water-supply. The water ran dry, and the tenant sued the landlord.

Held: "There was no contract that the house should remain fit for habitation."

[*Chester v. Powell*, 1885, 52 L.T., 722.]

NOTE.—Though this is not a case of infection, this is given as an instance that a house warranted to be in a sanitary or healthy state when let is not warranted to remain so, and it is inserted here as the question might arise in dealing with cases of infection.

*House Let (Furnished House); Noxious Insects (Bugs).*—Sir Thomas Marrable took a smart furnished house at Brighton for five weeks from Mr. Smith at eight guineas a week, from September 15, 1842. On September 16 Lady Marrable found the house infected with bugs, and made war upon them, but without success, although she was helped by a servant of Mr. Smith. Lady Marrable then gave notice that she would leave at the end of the week, paying one week's rent. She did this, and Mr. Smith sued for the balance rent due under the agreement.

PARKE, B.: ". . . These cases quite warrant the position that a tenant may immediately relinquish his tenancy of a house which is encumbered with a nuisance of so serious a nature as to make it uncomfortable and unfit to live in. There was no contract in this case on the plaintiff's part that the house was free from the nuisance; the contract was by the defendant, that he would take the house of the plaintiff at a certain rent, and then the law attaches a condition that the house shall be in such a fit state as from the description of the house might be reasonably expected. . . ."

LORD ABINGER, C.B.: "A man who lets a ready-furnished house does so on an implied condition or obligation that it is in a fit state for occupation. Suppose the defendant had discovered the fact that previous tenants had quitted the house in consequence of a person having recently died there of the plague, would not the law have justified him in leaving as soon as he discovered the fact? I entertain no doubt on the subject, and in this case I only wonder that the defendant remained so long and gave the landlord so much opportunity of trying to remove the nuisance."

[*Smith v. Marrable*, Exchequer Chamber, on appeal, Abinger, C.B., Parke, Alderson, and Garney, BB.; *Sutton v. Temple*, 12 M. and W., 60, 1843, L.J.Ex., 223. *Vide infra*, Poisons—Lead, p. 1046.]

NOTE.—Lord Abinger, C.B., in *Sutton v. Temple*, referred to, elaborated and restricted the judgment he here gave in the following

words: "I entirely approve of the decision to which we came in that case. That was the case of a contract of a mixed nature—for the letting of a house and furniture at Brighton—and everyone knows that the furniture upon such occasions forms the greater part of the value which the party renting gives for the house and its contents. In such a case the contract is for a house and furniture fit for immediate occupation; and can there be any doubt that, if a party lets a house and the goods and chattels or the furniture it contains to another, that must be such furniture as is fit for the use of the party who is to occupy the house? So it is in the case of other instances that may be supposed, for instance, if a carriage be let out for hire, and it breaks down on the journey, the letter of it is liable, and not the party who hires it. So, if the party hire anything else of the nature of goods and chattels, can it be said that he is not to be furnished with the proper goods, such as are fit to be used for the purpose intended? Undoubtedly the party furnishing the goods is bound to furnish that which is fit to be used."

### Workmen's Compensation Act.

*Blood-Poisoning*—"Accident" (W.C.A., Scottish).—While a man was engaged in sorting bones, one of the fingers of his left hand was penetrated by a portion of one of the bones. Blood-poisoning resulted from the injury, necessitating amputation of the finger.

Held: "The blood-poisoning was the consequence of the accident."  
[*Brown v. Cunning*, 1904, 5 F., 997.]

*Blood-Poisoning; Death*—"Inference of Accident" (W.C.A.).—The deceased was a repairer who lived some distance from his work. He arrived home one night with a crushed hand, not saying how or where it occurred, and he died some days after of blood-poisoning.

SIR GORELL BARNES: "If the known facts are equally consistent with either alternative, the plaintiff is not entitled to succeed, because no one can reasonably draw the inference in his favour; but where the known facts are not equally consistent, the case is totally different."

Held: "The County Court Judge was at liberty to draw an inference that the accident arose in the course of the employment if he considered it was more likely to have occurred when at his work than otherwise."

NOTE.—The interest in this case consists in the fact that the Court of Appeal held that the arbitrator may be entitled to draw an inference that a personal injury by accident arising out of and in the course of the employment has happened to a workman even where no direct evidence can be given of the circumstances under which such a personal injury had occurred.

[*Mitchell v. Glamorgan Coal Company*, 1907, 23 T.L.R., 588; 9 W.C.C., 16.]

*Blood-Poisoning*—"Accident" (W.C.A.).—On October 22, 1907, Mrs. Dewhurst pricked her finger with a pin in washing the cellar steps. Blood-poisoning supervened, and she lost the use of her hand.

She was entitled to compensation as if the blood-poisoning was part of the accident.

[*Dewhurst v. Mather*, 1908, 24 T.L.R., 819; 1 B.W.C.C., 328.]



*Blood-Poisoning*—"Accident" (W.C.A.).—The entrance of a piece of coal under the skin of the knee of a coal-miner who very frequently has to work on his knees is an accident. In this case blood-poisoning subsequently set in, and the man died fourteen days after the coal first caused him pain.

The blood-poisoning was held to be part of the consequences of the accident.

[Thomson v. Ashington Coal Company, 1901, 84 L.T.R., 412; 17 T.L.R., 345; 65 J.P., 356; 3 W.C.C., 21.]

*Blood-Poisoning*—"Accident" (W.C.A.).—A workman was taking his midday meal in his employer's stable, when he was bitten by one of the stable cats. The bite set up blood-poisoning, and two joints of the finger were amputated.

COZENS-HARDY, M.R.: "Part of what may be called the necessary furniture of the stable is the stable cat."

The blood-poisoning was held to be part of the consequences of the accident.

[Rowland v. Wright, 24 T.L.R., 852; 1 B.W.C.C., 192; 1909, 1 K.B., 963.]

*Erysipelas*—"Accident" (W.C.A.).—A workman was injured on September 2; erysipelas did not appear until September 16; he died on September 27. His own doctor stated that he would expect erysipelas in less than ten days, and that if erysipelas started more than fifteen days from the date of the wound he would expect that the wound had been reopened. The doctor for the master stated that erysipelas could only be caused by the introduction of germs, and that if the germs had been introduced when the wound was first made, he would have expected erysipelas to come out in six days at the most.

COZENS-HARDY, M.R.: "The applicant for compensation, therefore, has to show an accident causing injury, and death or incapacity resulting from the injury. In the present case there was admittedly an accident causing injury, and the only question is whether death in fact resulted from the injury. If death in fact resulted from the injury, it is not relevant to say that death was not the natural or probable consequence thereof. The question whether death resulted from the injury resolves itself into an inquiry into the chain of causation. If the chain of causation is broken by a *novus actus interveniens*, so that the old cause goes and a new one is substituted for it, that is a new act which gives a fresh origin to the after-consequences. In dealing with an obligation created by the Act, we are not dealing with a case of contract or tort, or with a liability of a criminal nature. In the case of contract, a person who commits a breach of it is liable for the consequences which naturally follow from the breach. So, too, in cases of tort, when the question arises whether a person is liable in respect of a breach of duty imposed upon him, he probably, and in some cases certainly, comes under a somewhat larger liability than would be the case if it were a breach of contract; but still the liability is measured by what are the reasonable and probable consequences of his breach of duty. That lets in the consideration of reasonableness. No question of reasonableness comes into the

present discussion. The Act has imposed the liability irrespective of any error of judgment or negligence on the part of the employer. The only question to be considered is, Did the death or incapacity in fact result from the injury? . . .

[*Dunham v. Clare*, 1902, 66 L.T.; 1902, 2 K.B., 292; 50 W.R., 596; 18 T.L.R., 645; 4 W.C.C., 102.]

NOTE.— By reference to the article on Infection, by Mr. Cheatle, at p. 443, it will be seen that the “incubation period” of erysipelas, in his opinion, is a few hours to two days. It is clear from this case (*Dunham v. Clare*) that the bacteria did not enter at the time of the injury, on September 2, as no symptoms occurred for fourteen days, and yet it was held by Collins, M.R., that the subsequent infection by the bacteria had not been a case where a “new act has intervened.”

*Blood-Poisoning; Septicæmia* (W.C.A.).—On January 14 the deceased was put to clean out a pond; this he did in about three weeks. The stench made him ill, and, as he was gradually getting worse, on March 5 he saw a doctor, who attended him till his death on April 20. The death was caused by absorption of micrococci in the glands at the root of the neck and general septicæmia, from which he died.

Held: “The case is governed by *Broderick v. L.C.C.* (see *Heart*), and that, as the infection was not an accident nor included under Section 8 and the third schedule of the Workmen’s Compensation Act, his dependants could not recover compensation.”

[*Mawson v. The Mayor, Aldermen, and Burgesses, of Evesham, Evesham C.C.*, Judge Ingham, March 13, 1909, 126 L.T.J., 428; *Policy Holder*, xxvii. 193.]

*Blood-Poisoning; Death* (W.C.A.).—A workman engaged on an engineering work had his thumb injured by a strand of rope, and an award was made in his favour; but some time after the award the applicant died from blood-poisoning. The duration is not stated, but liability does not appear to have been disputed on the ground that the blood-poisoning was not a consequence of the injury.

[*Atkinson v. Lumb*, 1903, 1 K.B., 861; 5 W.C.C., 106.]

*Infection by Chemicals; Death* (W.C.A.).—A chemist in a factory scratched his leg, and the wound afterwards became infected by chemicals, which caused blood-poisoning and death.

There was no dispute as to this being the consequence of the accident.

[*Bagnall v. Levinstein*, 1906, 8 W.C.C., 84.]

*Blood-poisoning—Whitlow—Not due to Accident* (W.C.A.).—The applicant, a servant-girl, claimed that when cleaning a stove one morning she knocked her finger, and that by the same evening—*i.e.*, in about twelve hours—her whole arm was swollen and tender, red lines running up it towards her armpit, where there was a gland enlarged by the inflammation. She did not dispute that the subsequent illness was not very serious; she never had to take to her bed, and the whitlow followed the usual course.

The employers set up in defence that she never had a whitlow in

consequence of the alleged accident, but had one before the date she gave; that the symptoms, as she described them, could not occur in so short a time, as the "incubation period," or interval between the initial injury and the appearance of such symptoms, would be longer than she had stated—viz., twelve hours.

Her own doctors admitted that at least twenty-four to thirty-six hours would elapse before such symptoms would appear.

The arbitrator held that the injury which occurred in the morning did not cause the whitlow.

[Lodge v. Marsh, Edmonton C.C., Judge Bray. Local papers, February 3, 1910.]

*Erysipelas; Date of Infection; No Evidence of Infection following an "Accident" Two Months previously* (W.C.A.). — Josiah Hugo was employed by Larkins and Co., fish-salesmen, at Billingsgate Market as a porter, and came home with a punctured wound in his hand. He was away from work for five days, April 19, 20, 21, 22, and 24. The hand was treated with an antiseptic dressing at a dispensary. The wound was bandaged, and subsequent to the injury the arm became red and swollen, but he was back at full work on April 23. On July 3 Hugo came home with his face swollen. He was attended by Dr. Bremner from July 7 to July 10, on which date he was sent to the infirmary, where he died on July 17.

Dr. Bremner, the man's own doctor, said that on July 7 Hugo was suffering from erysipelas in the face, head, and neck. He said that erysipelas was caused by a micro-organism entering a sore place. He had heard that it might take months from the period of the entry of the organism until it developed. He did not remember being told about a wound in the hand. There was what was called idiopathic erysipelas; but the general teaching was that there must be some scratch into which the organisms might have entered. It was possible that the erysipelas might have developed from the wound of April 17. The organism might have remained latent, and broken out in the head.

The man went to the infirmary on July 10, three days after he first saw Dr. Bremner, and Dr. Ingram, the infirmary doctor, said he saw no wound or bandage on the hand at that date. He did not think that a punctured wound on April 17 could have anything to do with the erysipelas in July. Erysipelas could be formed without a broken skin. Incubation is within two or three days. The period suggested by the applicant was too long. If the erysipelas entered the hand he would expect to see the erysipelas near the hand, and not in the face.

The Judge adjourned the case for the attendance of the medical assessor, who was merely asked the abstract question as to whether or not bacteria could lie latent under conditions for a long time. He said they might.

COZENS-HARDY, M.R.: "Judgment may be given in this appeal *post hoc, non propter hoc*. This workman had a puncture on his hand on April 17, and he went to the hospital, where his hand was bandaged. He was away four days, and then went back to work. It was not until July that he was found to be suffering from erysipelas, of which he died. Medical evidence was called in the

County Court, when the doctors called on behalf of the widow declined to say that the erysipelas from which the man died was due to the puncture on this hand. There was literally not a particle of evidence to justify the finding of the County Court Judge that the erysipelas was so due. There was a conflict of evidence between the doctors as to whether there was a possibility that erysipelas could have developed so late from the prick on the hand.

"The Judge of the City of London Court thought that he would like to consult a medical referee on this abstract question. The referee, it appears, was sworn as a witness, a course which, I hope, will not be followed as a precedent, though he was not cross-examined. The medical referee took the view that it was not impossible that erysipelas might have developed from a puncture on April 17; but he also said it might have been set up by other causes. His evidence was not given with regard to this particular man at all. There was not a particle of evidence to justify the finding of the Judge."

[Hugo v. Larkins, on appeal from the City of London C.C., Judge Rentoul, 3 B.W.C.C., 228.]

### INSANITY AND SUICIDE.

In civil actions, where the case hinges upon the discovery of a dead person, the cause of whose death is unexplained, as the strong presumption is against the commission of a crime, suicide must be proved, and cannot be inferred.

This presumption against crime was thus stated by Bowen, L.J., in a case which it is relevant to cite here, though it actually dealt with a different subject.

BOWEN, L.J.: "There is a broad principle that where defendant is attempting to set aside a transaction for illegality, and the facts connected with it are equally consistent with the transaction being legal or illegal, it lies on the defendant to prove the illegality. The law presumes against illegality. The principle is that no person shall, in the absence of criminative proof, be supposed to have committed any violation of the criminal law, whether *malum in se* or *malum prohibitum*, and that this presumption holds good in all civil and other proceedings for whatever purpose originated, and whether the guilt of the party comes in question directly or collaterally."

[Hire Purchasing Company v. Richens, 1887, 20 Q.B.D., 389.]

"I do not myself suggest suicide, because, suicide being a crime, the presumption is against it."—FARWELL, L.J.

[Bender v. Zent, 100 L.T., 639.]

In one instance the arbitrator expressly found as a fact that the deceased workman had not committed suicide.

[Mackinnon v. Miller, 2 B.W.C.C., at p. 67.]

(For the mental conditions of shock, neurasthenia, etc., see the title.)

#### Insurance.

**Acute Mania — Non-Disclosure : Suicide** (Insurance).—Actual words of questions answered: "Have you at any time had,

and if so when, mental derangement?" "What medical men have you consulted?"

The deceased lady, Miss Morrison, wishing to insure her life, filled in a proposal form, and was then examined, on behalf of the insurance company, by Dr. Bernard Scott, who put the above and other questions to her, and entered her answers on another form. She signed a declaration at the foot of this form that her answers were true, and should be the basis of her contract with the insurance company.

(In spite of this, however, the Court held that in this case they did not form the basis of the contract.)

Eight years before the date of this medical examination she had had an attack of acute mania, and was under the care of Dr. Morgan. She was confined in an asylum during a period of seven and a half months at this time, but she believed she was only undergoing a rest cure and was suffering from a nervous breakdown after influenza. The insurance doctor, Dr. Bernard Scott, knew of this "nervous breakdown," but she did not mention Dr. Morgan.

A policy of insurance was effected, and some time after she committed suicide, whereupon the insurance company repudiated liability.

The jury, at the trial, negatived the suggestion of fraud, and found that the deceased did not know she had been insane, but that the question was a material one for the insurance company to know. Dr. Bernard Scott, the insurance company's doctor, was not called at the trial.

VAUGHAN WILLIAMS, L.J.: "Question No. 7, 'What medical men have you consulted?' in my opinion required some necessary explanation. Some limit to this question must have been intended. It could not have been expected that Miss Morrison's answer should extend to early childhood. I do not know what limit was set by Dr. Bernard Scott in his explanation. . . ."

"I myself think there ought to be a new trial in this case, because I think, in the absence of any certainty as to what took place at the interview between Dr. Bernard Scott and Miss Morrison . . . it is very doubtful whether she may not have given Dr. Bernard Scott, if not full information, full means of information at this interview."

Held: "There must be a new trial, as it was impossible to say whether there had been any concealment or not."

[*Joel v. Law Union and Crown Insurance Company, C.A.*; reported in 24 T.L.R., 632; and 24 T.L.R., 898.]

**Drowning — Presumption against Suicide (Insurance).—** Words of the policy: "If the assured should sustain any injury by accident from an outward external and visible means or cause, and if the assured should die solely from the effects of such accident . . . the company should pay . . . £1,000."

The policy contained a further clause stating the company would not be liable in the case of suicide.

The deceased man was found drowned in a river, and the arbitrator found that he was in receipt of an income of £250; that he was in embarrassed circumstances at the time of his death; that he had written for money to a friend; that on a former occasion he had borrowed money off his sister, and he was found in a river near a

pathway along which he might have been walking to see his sister ; that there was no evidence as to how he fell into the river.

[Harvey v. The Ocean Accident Insurance Company, 1905, 2 I.R., 1.]

**Suicide—no Express Words against.**—Mr. Home insured his life for £300, there being no provision in the policy that it should be void if the assured died by his own hand. Mr. Home committed suicide while in a state of mental derangement.

Held: "That the policy was valid, and the personal representatives were entitled to recover."

[Home v. Anglo-Australian Insurance Company, 4 L.T., 142.]

**Suicide—Express Words against.**—The policy was to be void if the insured should "die by his own hands." Insured threw himself into the Thames. Jury found that he voluntarily threw himself into the water, knowing at the time that he should destroy his life, and intended thereby to do so, but at the time of committing the act he was not capable of judging between right or wrong.

Held: "The policy did not cover the death."

[Borrerdale v. Hunter, 1843, 5 M. and C., 639.]

**Suicide—Express Words against.**—In May, 1902, one Firnberg signed an application to the defendant company for a policy of £4,000 for five years on his own life, payable to the plaintiffs, Ellinger and Co., who were his creditors. In this application Firnberg stated, *inter alia*: "I also warrant and agree that I will not commit suicide, whether sane or insane, during the period of one year from the date of the said contract." The policy stated that it was made in consideration of the said application, which was thereby made part of the contract.

In February, 1903, Firnberg committed suicide while temporarily insane.

Held: "That the warranty against suicide was a condition, and that the death of the applicant by suicide during the first year was not covered by the policy."

[Ellinger v. Mutual Life Insurance Company of New York, 1904, 1 K.B., 832; affirmed 1905, 1 K.B., 31.]

**Suicide—Express Words against.**—Similar case: "Not to commit suicide during two years." Suicide within two years.

Held: "The policy was avoided, and the company was not liable for the sum insured."

[Mutual Life Insurance Company v. Kelly, 114 Fed. R., 268.]

### Negligence.

**Injury to the Brain of One who had a Predisposition to Insanity (Damages).**—The plaintiff was knocked down by a motor-car, receiving severe permanent injury to the brain, from which she became insane. She was a domestic servant earning £14 wages and her board and lodging. Damages £500.

[Smith v. Grant, 1909, *Times*, January 21.]

**Injury to Eye, Blindness, Softening of the Brain.**—See Brain.

**Workmen's Compensation Act.**

**Acute Mania, due to Accident, after return to Work (W.C.A.).**—The two legal points of this case were: (1) That though the workman returned to work, he did not abandon his rights under the agreement to receive compensation for the consequences of the accident; and (2) that, after the death of the workman, the dependants' rights were separate from those of the injured man.

On September, 3, 1904, Williams, a collier, was injured. He received compensation, and, after an absence of twelve months, returned to work at a different class of labour, at which he earned more than before. He complained frequently of the after-effects of the accident. He worked up to July, 1906, and died in the Denbigh Asylum on September 23 in the same year from acute mania, which the County Court Judge found to have been brought on by the accident.

COZENS-HARDY, M.R.: "I think that under the Act a workman's dependants have a separate right in the event of his death in such circumstances, and one which the workman cannot abandon or deprive them of except in this sense—that the Act contemplates that the employer is not from first to last to be bound to pay more than the maximum compensation given by the Act, and he is entitled to take credit for any sums advanced by way of weekly payments."

[Williams v. Vauxhall Colliery Company, Ltd., 1907, 2 K.B., 433; 9 W.C.C., 120.]

**Blindness: Insanity; Suicide—"Accident"** (W.C.A., Scottish).—Workman, partially blind in one eye, lost use of other by splinter of iron entering it. He became insane owing to the gradual loss of sight in the remaining eye, and committed suicide.

Held: "The arbitrator can hear evidence to show suicide was caused by the accident."

[Malone v. Gayzer, Irvine and Co., 1908, S.C., 479; 1 B.W.C.C., 27.]

**Fractured Skull: Insanity—"Accident"** (W.C.A.).—On November 4, 1902, some machinery fell on the head of a workman and fractured his skull. "He gave up work for some weeks and went to the hospital. He came back to work, but was eventually dismissed from his employment. Then he got work elsewhere, but found that he was not able to work, and finally he became a lunatic in November, 1903."

[Lowe v. Myers, 1906, 95 L.T., 35; 8 W.C.C., 22; 1906, 2 K.B., 265; 75 L.J., K.B., 651.]

**Insanity: Suicide** (W.C.A.).—The applicant's deceased husband had met with two accidents when at work in a colliery.

In 1889 he had his hand crushed; it became gangrened, and had to be amputated. He also suffered from shock to nervous system.

In 1903 he was kicked in the groin by a horse. From this time he was off work for seventeen months, and was never mentally sound afterwards; in 1908 he committed suicide while insane.

The employers had been held liable for both these accidents, and it was argued that there was a clear chain of causation between the accidents and the suicide. The medical evidence conflicted, and the arbitrator made an award in favour of the respondents.

The applicant must do more than say "there was a possibility of the death arising from the injury." She must prove that the injury caused the insanity, and that the insanity caused the suicide.

[Richards *v.* The Ocean Coal Company, 1908, *Policy Holder*, xxvi. 786.]

## INTESTINES.

The injuries and diseases of the intestines which give rise to an action for damages include hernia (or rupture) and ptomaine-poisoning; these are both the subjects of separate sections. "Enteritis," which simply means inflammation of the intestines, may be due to many causes. The following forms of it have recently been before the Courts: Typhoid fever (due to the *Bacillus typhosus*), sewer-men's enteritis, and acute ulcerative colitis.

**Typhoid Fever: Milk—Contract** (Sale of Goods Act, 1893, Section 14).—Implied warranty of fitness for food. Milk was supplied to the plaintiff by the defendant, and he gave away to his customers a special printed book which stated that numerous precautions were taken to avoid infection of the milk. The plaintiff's wife died of typhoid fever, and it was found by the jury that infection in the milk was responsible for the death.

Held: "The milk was sold under an implied warranty of fitness, and the buyer relied on the seller's skill. In the ordinary course milk is supplied without any inspection. It is delivered by the seller at the buyer's house, and there is no suggestion that any judgment can be exercised by the buyer in respect of it."

[Frost *v.* The Aylesbury Dairy Company, 1905, 1 K.B., 608.]

**Sewer-men's Enteritis—No "Accident"** (W.C.A.).—A sewer-man contracted enteritis while working in the L.C.C. sewer. The contraction of this disease was held not to be an accident, as the enteritis was acquired gradually in the course of the employment.

COZENS-HARDY, M.R., quoted Lord Lindley in *Brintons, Ltd., v. Turvey*, who said: "I hope that the decision in this case will not be regarded as involving the doctrine that all diseases caught by a workman in the course of his employment are to be regarded as accidents within the meaning of the Workmen's Compensation Act."

Continuing, the M.R. said: "The Act of 1906 also contains provisions in Section 1 for compensation for certain scheduled or trade diseases, as if they were "injury by accident arising out of and in the course of the employment," indicating that such diseases were not considered to be accidents. What the applicant was suffering from was not one of the diseases mentioned in the schedule."

For further discussion on this case, *vide supra*, *Heart*, p. 959, as the real trouble was that of the weakening effect of the enteritis upon the man's diseased heart.

[*Broderick v. The L.C.C.*, 1908, 2 K.B., 807; 24 T.L.R., 822; 1 B.W.C.C., 219; affirmed in a similar case, *Eke v. Hart-Dyke*, *Times*, July 13, 1910.]



**Acute Ulcerative Colitis.**—This was held to have been caused by lead-poisoning, but the case was *not* referred to the medical referee. See Poisons—Lead, p. 1048.

[*Smith v. Waring and Gillow*, Westminster C C., Deputy Judge. Local papers, May 1908.]

## JOINTS.

Disease of the joints without any accident connected with it is at least equally common as injury to a joint caused by an accident. Old disease, especially rheumatism or gout, or a former accident which produced a loose or displaced cartilage of the knee, is, rightly or wrongly, the foundation of many claims for damages or compensation.

Gonorrhœa should always be suspected in alleged injury to the knee or to the sole of the foot. See Flat-Foot, p. 340.

Incapacity is frequently claimed to have arisen from an injury to the fingers having produced a permanent stiffness in one of the joints. This in many cases is cured by the removal of the finger which, by its obstruction alone, prevents the free use of the hand.

*Vide supra*, Operation, p. 24; and for the effects of amputation, *vide supra*, Amputation, p. 869.

## Insurance.

*Dislocation of Shoulder; Pneumonia* (Insurance).—Words of policy: “Sustain any injury caused by an accident, and die from effects of such injury.”

Deceased fell and dislocated his shoulder, and died from pneumonia caused by cold, but would not have died but for the accident, since pain reduced his vitality.

HUDDLESTON, B.: “These words appear to me to mean that the injury must be immediately caused by the accident, but that the death need not be immediately caused by the injury. . . . The question of law is whether or not . . . the chain of circumstances ought to be taken into consideration as ‘effects’ under this insurance. I answer in the affirmative.”

[*Isitt v. Passengers’ Assurance Company*, 22 Q.B.D., 504.]

**Dislocation of the Internal (Semilunar?) Cartilage of Knee** (Insurance).—The plaintiff effected an insurance with the defendants against “any bodily injury caused by violent, accidental, external, and visible means” . . . “provided always that this policy shall not cover . . . injury . . . arising from disease or weakness . . . although accelerated by accident.”

The plaintiff was a tradesman carrying on business at Penzance. He was standing by the counter of his shop, the floor of which sloped away from where he was standing. A customer came into the shop with a child, and the child dropped a marble, which the plaintiff stooped forward to pick up as it rolled from him.

His evidence was, that he was standing with his legs together; he then separated his knees and leaned forward, and made a grab to get at the marble; that in doing so he wrenched his knee, and could

not get it straight again. The plaintiff was disabled for nine weeks. He had not previously suffered from any weakness in the knee or knee-joint. The injury from which he suffered was described as a dislocation of the internal cartilage of the knee-joint.

The question of the liability of the company to pay compensation was referred, under the conditions of the policy, to arbitration, and the arbitrator awarded the plaintiff £60 and the costs of the arbitration. The latter were paid into Court, and the learned Judge directed a verdict for the plaintiff for the £60, and gave judgment for that amount beyond the sum paid into Court.

The defendants appealed.

LORD ESHER, M.R.: "He did not mean to wrench his knee, and that would not be the ordinary result of such an action. Then, was the cause of the injury something violent? That expression must be construed as meaning the contrary of 'without any violence at all,' which would not describe what happened. The word 'external' is that which has caused me most doubt, but I feel sure that in this policy, looking, as we are bound to, at the rest of the policy and the things that are excepted from it, the expression must be taken to mean the antithesis of 'internal.' If the injury had happened by reason of something internal, it would not be within the policy; but that is not the case, and I think we must say that because the cause of the injury was not internal it must have been 'external,' and in that case it was also 'visible' within the meaning of the policy. I think, therefore, that the case is brought within the terms of the policy, and that the plaintiff was entitled to succeed in the action. The appeal must therefore be dismissed."

LOPES, L.J.: "Looking at the contrast between matters external and matters internal, it is suggested that the resistance of the floor supplies the external cause. I think a more obvious cause is the act of reaching after the marble and the wrench which accompanied that act. That stooping and reaching after the marble was certainly not an internal cause, but was, in my opinion, an external cause within the policy. Once admit that there is an external cause, it is plain that it was a visible one, and that condition also of the policy is satisfied. The plaintiff, therefore, is entitled to verdict and judgment."

A. L. SMITH, L.J.: "By what means was the plaintiff injured and his knee put out? There cannot be a question that the means were violent. They were also accidental, for getting into the particular position in which the injury could happen was not done on purpose. Then, were they external? I think the word must be understood as meaning the opposite of internal. The means by which the injury was caused were the stooping on the part of the plaintiff and his grabbing at the marble to pick it up, and I think they may be properly described as external. If so, the last word 'visible' applies, for anyone looking on could see the stooping of the plaintiff. Under these circumstances the words of the policy are satisfied, and the appeal should be dismissed."

[*Hamlyn v. Crown Accidental Insurance Company*, 1893, 1 Q.B.D., 750; Court of Appeal, Lord Esher, M.R., Lopes and A. L. Smith, L.JJ., on appeal by the defendants from a judgment of Lawrence, J., and jury.]

The cases of injury to the joints are classified medically as follows : (1) Injury to healthy joints ; (2) injury to diseased joints ; (3) disease of joints arising after injury ; (4) operation and treatment.

### Damages and Lump Sums in Redemption of Compensation.

#### Shoulder, Arm, and Hand :

*Joints : Little Finger, Top Joint stiff—Agreement in Full Settlement (W.C.A.).*—The applicant, who was a kitchenmaid aged twenty, injured the little finger of her left hand, and the top joint became permanently stiff. For twelve weeks she received full compensation, and was then paid £15 in full settlement under an agreement which she at once objected to being recorded, as she said the sum was too small. She swore that she was forced to accept the £15 because the weekly compensation was suspended, and that she became desperate from want of means.

Shakespeare, for the defendants, said the girl was still earning as much as, if not more than, formerly, that the girl's father wrote the insurance company long treatises on the Workmen's Compensation Act, that he knew all about it when he allowed his daughter to accept the £15, and that the girl was never desperate for the want of money.

It was further given in evidence that the girl's father knew that the case was coming before the Court ; but neither he nor the girl supported the objection to the £15 being recorded. The company suspended the weekly payments only because the girl would not allow her hand to be medically examined.

Held by the Judge: "That, as the applicant had received £21, the agreement was fair."

[*Glover v. Howse, Mead and Sons, Ltd.*, City of London Court, Judge Lumley Smith. Special report on April 27, 1908, by Mr. Henry A. Grover, official reporter.]

#### Leg and Foot :

See below, Incapacity (*Savill v. Lewis*).

### Duration of Incapacity.

#### Shoulder, Arm, and Hand :

*Shoulder : Dislocation (W.C.A.).*—Shoulder dislocated in October, 1898 ; still unable to work on October 12, 1899. Incapacity lasted one year.

[*Bennett v. Aird and Sons (County Court)*, 1899, 107 L.T.J., 550 ; 1 W.C.C., 138.]

*Shoulder : Dislocation ; Injury to Nerves of the Shoulder—Negligence.*—The plaintiff was injured in getting off a L.C.C. tramcar. In consequence his shoulder was dislocated, and he was unable to follow his employment for sixteen weeks, and Dr. Davis, senior house-physician of the Royal Free Hospital, said that there was wasting

of the muscles of the shoulder, indicating injury to the nerve, which was permanent. Incapacity, sixteen weeks and more.

[*Bassi v. L.C.C., Clerkenwell C.C., Judge Edge. Local papers, May 5, 1908.*]

*Shoulder : Stiff after Fracture (W.C.A.).*—The medical point of this case is the stiffness which remained in the shoulder joint, though the injury produced by the accident was a fracture. On October 25, 1898, the shoulder was broken and put in splints till December, 1898.

The workman was then told to move his arm as much as possible ; the direction was repeated at the end of December, and again in the middle of February, 1899.

In March, 1899, the employers stopped compensation on the ground that his incapacity after this date was due solely to his neglect to follow the directions given to him.

The County Court Judge found that, had the man followed the instructions, he would have been well by this date, March 27, but that the applicant was a man of very nervous temperament, and that this constitutional and natural nervousness, intensified to some extent by the accident, was the reason why the applicant did not carry out the directions of the medical men, and that this neglect had delayed his recovery, and was the cause of his present inability to work ; that his neglect to obey the instructions was not the result of wilfulness or carelessness, but was due to the nervous condition which he appeared to have been unable to control.

ROMER, L.J. : "The pain caused probably by following the doctors' instructions to exercise the arm might have an effect upon a nervous man, and prevent him from continuing to follow the instructions."

Held : "Still incapacitated from work by the accident."

[*Smith v. Coed Taton Colliery Company, Ltd., 2 W.C.C., 121 ; Court of Appeal, A. L. Smith, Collins and Romer, L.JJ.*]

See, however, numerous later cases under Operation, p. 24, some of which must be distinguished from this judgment.

*Elbow Dislocated (W.C.A.).*—The applicant, who was a gardener, on July 24, 1909, fell from a ladder through a glass skylight, cutting himself considerably and dislocating his left elbow. The dislocation was reduced under an anæsthetic with excellent results, but the man said he could not do his full work before April, 1910. He said his arm was still stiff, and that there was some anæsthesia of the skin of the forearm. Compensation was stopped on December 1, 1909.

The Judge, sitting with the medical assessor, found that he should have returned to light work—which was offered to him by his old employers—in December, 1909 ; that had he done so he would have been entirely recovered by February 1, 1910.

Arbitration was held on April 11, but as the applicant in his particulars, filed at the end of January, had claimed "total incapacity" of an "indefinite duration," the Judge awarded costs on the lowest scale, "A." Incapacity lasted seven months.

[*Judge Bray, Wandsworth, C.C., April 11, 1910.*]

*Left Wrist (W.C.A., Scottish).*—"He was attended by the doctor daily for four weeks, and thereafter less frequently until the date of the hearing." Date of the accident, February 24, 1899.

Hearing, June 14, 1899. "In driving in a wedge strained left wrist, whereby he has since been unfit for work." Nearly four months' incapacity, and still continuing at the date of the arbitration. [Shearer *v.* Miller and Sons, 1899, 2 F., 114.]

*Hand: "Hurt on the Hand"* (W.C.A.).—The applicant, a bricklayer's labourer, two years ago had injured his hand, and had been awarded full compensation, which was afterwards reduced to 6s. 9d. a week, as he was able to do light work. After some time the applicant again applied for an increase, on the ground that he had again been unable to find work. His Honour adjourned the case, as he found it difficult to make up his mind whether the man had not been able to work as the result of the accident, or because he did not choose to take such work as he could get, and, further, whether the man had done his best to get such work as he could do. His right hand was crippled to a certain extent, and he could not do work on the ladder. The employer gave evidence that he had offered the applicant light work. The applicant said before he could do anything he must see his secretary (of his trade union). The Judge said, "If he did not accept it because it was not the trade-union wage he was not complying with the Act of Parliament," and refused to increase the award. Two years' incapacity.

[Brand *v.* Gregor, *Stafford Express*, May 16, 1908, Bow C.C., Judge Smyly.]

### Leg and Foot :

*Hip injured—Negligence.*—On December 12, 1907, the plaintiff was walking along the road, and fell into a hollow on the path near some newly-built houses. She cut her hands, hurt her hip and her knee, and on February 10, 1908, she still complained of her hip. Her doctor said the condition "more likely than not would be permanent." Incapacity lasted two months or more.

Damages £52 10s., including doctor's fees and extra assistance.

[Savill *v.* Lewis, Romford C.C., Judge Tindal Atkinson. Local papers, February 10, 1908.]

*Knee* (W.C.A.).—A workman, while crossing a plank, slipped his foot and injured his knee on February 12, 1907. On October 8, 1907, his doctor stated: "It is too early yet to talk about his chance of getting back to his former work. In three months' time he might be able to do some light work." Incapacity about a year.

[Taylor *v.* Jones, Ely C.C., Judge Mulligan, 1907, 123 L.T.J., 553; 1 B.W.C.C., 3.]

*Knee: Semilunar Cartilage displaced* (W.C.A.).—The applicant was employed in delivering bread, and said that, "something going wrong with his cart" as he was coming into the yard, he was twisted round and thrown on the ground. He said that some time before, in running after a rat, his foot had slipped, and his knee had gone in sideways and had become sprained. He said this was quite well when he went into the employment of the respondent. The medical evidence for the respondent was that the effect of the first accident was the cause of the trouble, and not the second.

Dr. Lauzun Brown, of Goswell Road, speaking of a piece of cartilage that was already loose, said the piece of cartilage might have slipped out while the applicant was walking along the road. A doctor might have a loose cartilage slip out while he was walking, and all he could do would be to slip it back. In this case the loosening of the cartilage would be caused by the first accident, not by the second. It was not quite back now, and he should consider an operation advisable, but not urgently necessary. The Judge said he was not satisfied that the second accident had anything to do with the displacement of the cartilage, but no doubt the applicant sustained some injury, and awarded £7 4s.

[*Carter v. Bonner*, Woolwich C.C., Judge Willis.]

*Ankle sprained—Negligence not proved.*—The plaintiff said that as he was passing the defendant's door it was burst violently open, throwing him down. In consequence, he said, he attended Poplar Hospital, and was unable to work for several weeks. The defence was that he had not been knocked down, not even struck. A certificate was put in by the plaintiff to the effect that the plaintiff had suffered from a sprained ankle; but when the doctor from the Poplar Hospital was called to give evidence, he said, although he gave the certificate, he could find no trace of sprained ankle, and that doctors had to rely on what a person told them.

Judgment for the defendant, with costs.

[*Riley v. Wollenweiber*, Bow C.C., Judge Smyly. November 9, 1907.]

## 2. Injury to Diseased Joints.

*Thumb: Gout (W.C.A.).*—The workman was holding a "flatter" for another workman, the hammerer, to strike it. A mishit by the hammerer jarred the workman's hand. The workman had previously to the accident suffered from gout in the hand and elbow, and the medical evidence was to the effect that the jar brought on a fresh attack of gout in the hand.

LORD JUSTICE COLLINS remarked: "There was the accident and the consequent injury, and the extent of the injury must depend upon the condition of the constitution of the person injured at the time of the accident."

[*Lloyd v. Sugg and Co.*, 1900, 16 T.L.R., 65; 2 W.C.C., 5.]

*Knee-Joint: Synovitis existing before the Accident (W.C.A., County Court).*—A workman slipped into a trench, and alleged that his left knee, which was suffering from synovitis, or the inflammation of a certain membrane of the knee, was injured.

The Judge found: "The applicant now contends that he was incapacitated because he was lame, but I have to remember that he was lame from synovitis on August 5. I am about to say that the applicant was just as much incapacitated from following his employment on August 5 as between that date and September 29. I am not satisfied that the applicant was ever really incapacitated from following his employment."

[*Shier v. Highbridge Urban District Council*, 1 B.W.C.C., 347.]

### 3. Disease of Joints arising after Injury.

*Rheumatic Fever—Negligence.*—The plaintiff, a servant, was told to help her master to bail water out of a cellar which was flooded, when she got her feet wet. In consequence of this she alleged she became ill with rheumatic fever.

The arbitrator decided against the girl on the ground that the illness could not be traced directly to wet feet.

[St. Albans C.C., Woodgreen; Mr. Edge, arbitrator. Local Papers, March 28, 1908.]

*Osteo-Arthritis (W.C.A.).*—The applicant fell from a pair of steps, and was discovered to be suffering from osteo-arthritis. Dr. Hershshed said that all trace of rheumatism had disappeared when he examined the plaintiff.

The Judge awarded twelve weeks' compensation.

[(No name), Shoreditch C.C., Judge Smyly. Local papers, May 13, 1908.]

### 4. Operation and Treatment.

*Dislocation of Internal Semilunar Cartilage of Knee—Reasonable Operation (W.C.A., County Court).*—The applicant slipped and hurt his right knee. He was paid compensation for thirteen months, and was recommended by his own and the applicant's doctors to undergo a "slight surgical operation, involving the removal of a loose internal semilunar cartilage." This would render him a perfectly sound man, able to resume his former work. Mr. Rowlands, assistant surgeon at Guy's Hospital, said he had never known the operation to be a failure, and it was performed thirty-five times a year at Guy's Hospital with every success. The man's own doctors said that there was some small element of risk in taking chloroform, but they both admitted that, if they were in Fairweather's position, they would unhesitatingly undergo the operation, knowing how small was the chance of a mishap."

[Gilbert and Co. v. Fairweather, *Times*, March 17, 1908, 1 B.W.C.C., 349.]

*Ankle—Incapacity due to Non-Submission to Simple Treatment (W.C.A., Scottish).*—August 31, 1899, the applicant was injured by being struck on the ankle of the right foot by a piece of iron, September 28, application to review. Dismissed. April, 1902, further application to review, nearly three years after the injury, the condition then was as follows: "Thickening of the joint externally, considerable immobility and pain on pressure immediately below the right ankle. There is no ankylosis of the joint, and there has been no fracture, and this I verified by X-ray examination of both ankles" (report of the medical referee, May, 1902).

SHERIFF (arbitrator) found: "The present condition of the ankle is due, not to the accident, but to want of proper treatment since the accident took place;" and he thereupon ended the weekly payments.

LORD ADAM: "What the Sheriff means to affirm is that, had there been proper treatment, the ankle would have been cured, and therefore its present condition is entirely due to want of proper treatment. The referee's report under this section was held not to

be final, but I think the Sheriff's judgment, which gives effect to the report, is final, because it is a judgment on a question of fact."

[*Dowds v. Bennie*, 1902, 5 F., 268.]

*Knee: Injury; Operation, Unreasonable Refusal* (W.C.A.).—The workman refused to have a small operation on the knee in spite of advice from his own and other doctors.

Held: "Unreasonable refusal."

[*Paddington Borough Council v. Slack*, 2 B.W.C.C., 402.]

*Knee: Injury; Operation, Unreasonable Refusal* (W.C.A., County Court).—The workman refused to undergo an operation which, in the opinion of the medical men, would restore the full use of the knee.

Held by the County Court Judge "unreasonable refusal" (Judge Thomas, Liverpool).

[*McNicholas v. Mersey Docks*, 1909, *Post Magazine*, lxx. 79; see also *Paddington Borough Council v. Slack*, 2 B.W.C.C., 402.]

## KIDNEY.

*Golder v. The Caledonian Railway*, where an accident happened to a man suffering from old kidney disease, is the leading case of a disease which was existing before the injury, and, being accentuated by the accident, was held to be part of the consequences of the accident (*see below*). It was held that the applicant was a man who was suffering from kidney disease, of which he died, and that in consequence of an injury the disease was accelerated, and so caused the death at an earlier date than would otherwise have been anticipated.

Medically, cases of injury to the kidney fall into four classes:

(1) Direct injury to the kidney; (2) disease of kidney aggravated by injury; (3) disease arising after an injury or from an industry; (4) operation and its relation to kidney disease.

## Insurance.

*Injury to Cancerous Kidney* (Insurance, American).—"Words of the policy which insured 'against likely injury sustained through external, violent, and accidental means' . . . 'independent of all other causes . . .'" The deceased, endeavouring to close a window-sash, used a long pole, which slipped, and in consequence he fell against the edge of a table and ruptured his kidney, which caused his death.

He had a cancer of the kidney, which would not have killed him so soon as the date upon which he died. The Appellate Court confirmed the judgment of the Court below in favour of the plaintiff.

Held: "That if an accident ruptures a kidney, and the resulting hæmorrhage causes the death of the insured, the fact that a cancer in the organ is a predisposing cause of the hæmorrhage does not prevent the death from being the result of an accident 'independent of all other causes.'"

Further held: "That the 'causes' referred to in a policy insuring against injuries sustained by accident, 'independent of all other causes,' are the proximate or direct, not the remote, causes of death."

(N.B.—This is a case of death from *injury* to a diseased kidney—not a case of the disease by its progress causing death, but of the



injury being far more serious in its effects because the kidney was diseased.)

[Fetter *v.* The Fidelity and Casualty Company, 97 Am. St. Rep., 560.]

### Negligence.

*Injury to Kidney—Negligence; Malingering.*—This has been claimed to have been produced by a blow upon the back, and an interesting case of this kind was communicated to us by Dr. T. David Lister, of a man who recovered compensation for a series of accidents which he said he sustained under various circumstances, and which he alleged produced inflammation of his kidneys and blood in his urine. He was paid damages on two occasions, but, fortunately, was caught on the third, for he had long suffered from a disease which is perfectly well known suddenly to produce blood in the urine without any external cause or actual disease of the kidneys, other than, perhaps, cold. The disease is paroxysmal hæmoglobinuria.

### Workmen's Compensation Act.

*Nephritis pre-existing, and aggravated by the Accident* (W.C.A., Scottish).—The workman, on a railway, was travelling upon a bogie, and in endeavouring to get off it he was thrown on his head. This was held to have accelerated his nephritis, from which he had long suffered.

The LORD PRESIDENT said that "the said John Golder was affected with nephritis, a disease which was likely to prove fatal to him, though probably not for a few years. He was injured about the head, back, and sides, on February 28 last (1902). . . . In consequence of the injuries so received he left off work for three weeks and two days, after which he returned to respondents' employment as watchman, being understood to be still unfit for his former duties. The shock of the aforesaid injury, however, so lowered his system that the disease, nephritis, from which he was suffering was accelerated in its action, and he died of it on May 8, 1902."

Held: "The workman died from the effects of an accident."

[Golder *v.* The Caledonian Railway, 1903, 5 F., 123.]

*Bright's Disease existing before the Accident, and accelerated by it* (W.C.A., County Court).—The workman fell down some cellar steps on May 22, 1908. He was alleged to have been a heavy drinker, failing in health two years before he died. He broke two ribs by his fall, and was away from work for four weeks; he then returned for fifteen weeks, and died on November 3. His death was certified by Dr. Orr as due to chronic Bright's disease accelerated by the accident.

Held: "The accident accelerated his death, and the respondents are liable."

[Marsden *v.* Huddersfield Corporation, 1909, Judge Gent, Huddersfield, *Policy Holder*, xxvii. 274.]

*Nephritis (Granular Kidney) as a Sequela of Lead-Poisoning.*—Haylett in August, 1907, was working for Messrs. Vigor; in September there were signs of plumbism; on September 25 all trace of plumbism had passed away. He died on October 2. The learned County Court Judge found—

1. That the immediate cause of death was granular kidney.

2. That granular kidney is a sequela of lead-poisoning, but is also a sequela of gout, alcoholism, heart disease, and other complaints.

3. That lead-poisoning was not proved to have been the cause of the granular kidney or of the death.

Held: "The onus of proving that death resulted proximately or ultimately from the disease (lead-poisoning) rests upon the applicant, notwithstanding the words of Section 8 (ii.) of the Workmen's Compensation Act."

COZENS-HARDY, M.R.: "The question turns upon the true construction of Section 8, subsections (i.) and (ii.). Now, the section has no application unless Haylett's death was 'caused by' a 'disease mentioned in the third schedule.' The material words in the third schedule are 'lead-poisoning or its sequela.' In my opinion these words have no operation unless it is established to the satisfaction of the County Court Judge that lead-poisoning was either the proximate or the ultimate cause of death. It is not sufficient that death was caused by something which may in some cases be a sequela of lead-poisoning, but may also be a sequela of gout or alcoholism. In short, it must be proved that death was a consequence of lead-poisoning in the case of this particular individual, not necessarily the direct or immediate consequence, but at least a remote consequence. Now, all that is proved is that Haylett died of granular kidney. That does not suffice to bring the case within the operation of the section."

[Haylett v. Vigor and Co., Bow C.C., Judge Smyly. Local papers, June 27, 1908; Court of Appeal, 1908, 24 T.L.R., 885; 1 B.W.C.C., 282.]

### Operation.

*Bright's Disease; Risk of Anæsthesia.*—On a question of operation, the man's doctor "advised him not to undergo an operation, as he was suffering from Bright's disease of the kidneys, which would render it dangerous to have anæsthetics administered." The operation was one to cure double rupture.

[Tutton v. The owners of the s.s. *Majestic*, 1909, 129 L.T.J., 644; 2 B.W.C.C., 346.]

### LIVER.

For effects of accident on the liver, which owing to alcohol is diseased (cirrhosis of the liver), see case on Alcohol.

### LUNGS.

Medically considered, the cases under lungs are those which arise under the following circumstances:

1. Direct injury.
2. Spread of infection from an injured part by direct inhalation or by means of the blood.
3. Disease arising or aggravated in consequence of lowered vitality caused by the injury.

Many cases of direct injury to the lungs and their coverings are associated with broken ribs. See Bones—Ribs.

## Insurance.

*Septic Pneumonia, Septicæmia, Erysipelas: Injury to the Leg (Insurance).*—Terms of the policy: "In the event of the insured sustaining any personal injury caused by *accidental and external violence*, the company bound themselves to pay . . . if such injury shall be the direct and sole cause of the death of the deceased within three months of the happening of the injury. . . . Provided further that this policy applies only to death directly and solely caused by some outward visible means . . . and does *not apply to death caused by* or arising wholly or in part from disease or other intervening cause, even although the disease or other *intervening cause* may either directly or otherwise be brought on or result from accident. . . . The word 'disease' in this policy means typhus, scarlet fever, or typhoid fever, smallpox, diphtheria, or measles. . . ."

The plaintiff on July 2 scratched the side of his leg with his thumbnail. The wound inflamed, and by July 9 erysipelas had set in in the wound. By July 12 septicæmia set in, and was followed by septic pneumonia, of which he died on July 22.

Septic pneumonia was the cause of the death, and in the opinion of the medical men it was consequent upon the wound, and but for the wound he would not, in their opinion, have had septic pneumonia.

"It was agreed in this case that the poison was introduced at the time of the accident, and it was held that the morbid condition of the illness which ultimately proved fatal was directly and solely caused by the wound."

Held: "That the erysipelas, septicæmia, and septic pneumonia, were not intervening causes within the meaning of the policy, but merely different stages in the development of the septic condition which was immediately brought about by the introduction of the poison, and that the man's death was directly and solely caused by the accidental injury to his leg."

[Mardorf v. The Accident Insurance Company, 1903, 1 K.B., 584.]

*Pneumonia (Insurance).*—Terms of the policy: "That this policy only insures against death . . . where *accident* within the meaning of the policy is the *direct or proximate cause* thereof, but not where the direct or proximate cause thereof is *disease or other intervening cause*, even although the disease or other intervening cause may itself have been aggravated by such accident, or have been due to *weakness or exhaustion consequent thereon*, or the death accelerated thereby."

Deceased when hunting fell into some water; though he was wetted, he suffered "no trauma or wound to the body or lung, but he did suffer a severe shock to the system whereby the general vitality of his body was impaired."

It was found by the arbitrator that the shock lowered the vitality so as to render the onset of the pneumococcus possible, and the onset took place an hour and a half after the accident; also it was found that the pneumococcus is generally present in the lungs, but remains innocuous unless and until the resisting powers of the lungs are impaired. Contemporaneously with the lowered vitality is the multiplication of the pneumococcus, and when this occurs in an

impaired lung, as happened here, the result is pneumonia, which, as in this case, may be fatal.

LORD JUSTICE VAUGHAN WILLIAMS: Disease or other intervening cause meant something new and independent of the accident. The appellants contended that it meant some new cause, but that it mattered not whether it was dependent or independent. He did not agree with that. When it was a dependent cause, one had a right to say that the direct or proximate cause did not consist merely of the immediate results of the accident, but included all those things which could fairly be considered as the usual attendant results of the particular accident in question. The facts here were that the assured had a fall from his horse, which was undoubtedly a heavy fall; and although the fall involved no breakage of bones, nor any wound, nor any obvious internal hurt, it caused a great shock accompanied by a serious wetting, and by the necessity of riding home without a change of clothes. The first result of that would be likely to be a lowering of vitality of the person subjected to such a shock. And in the next place it seemed to him to be beyond a doubt that such a lowering of vitality would be likely to produce a great development of the pernicious activity of those germs which were said to exist in the respiratory organs of every human being, and that, unless vitality were quickened, this pernicious activity of germs would certainly produce pneumonia. He thought that it was impossible to limit the proximate cause of the death to one part of the accident. The truth was that an accident ordinarily, according to its nature, produced certain consequences, and if death resulted as the final step in the consequences, the whole train of events was the proximate cause of the death which resulted. In his opinion "intervening cause" in this policy meant a cause independent of the accident and its ordinary consequences. Notwithstanding the fact that it would be natural to construe the words "weakness or exhaustion consequent thereon" as covering a case where the weakness or exhaustion was brought about by the accident itself, he was of opinion that in this policy those words ought not to be so construed. The appeal was therefore dismissed.

[*Etherington v. The Lancashire and Yorkshire Insurance Company*, 1909, *Policy Holder*, xxvii. 106; 1909, 1 K.B., 591.]

*Pneumonia—Accident* (Insurance).—Terms of the policy: "Sustain any injury caused by accident," and should die from "the effects of such injury" within three months from the time when it took place.

On October 24, 1887, the assured fell down and dislocated his shoulder, which was reduced on October 31. A few days after he was discovered to be suffering from pneumonia, and he died from that disease in less than a month from the date of the accident.

Found by the umpire: "That he died from the pneumonia caused by cold, but that he would not have died as and when he did had it not been for the accident; that as a consequence of the accident he suffered from pain, and was rendered restless, unable to wear his clothing, weak, and unusually susceptible to cold, and that his catching cold and the fatal effects of the cold were both due to the condition of health to which he had been reduced by the accident."

HUDDLESTON, B.: "More shortly, the assured fell and dislocated

his shoulder; he was in consequence confined to his room; he there suffered pain, became restless and unable to wear his clothes, and was reduced to a condition of debility. He thus became unusually susceptible to cold, and in consequence pneumonia; and he died of pneumonia. These facts appear to me to constitute a chain of circumstances naturally from the injury to the death."

WILLS, J.: "The question is very like those which often arise in respect of damages. Damages must be, all the circumstances taken into consideration, not too remote, but the natural consequence of that which gives the right to recover them. Was, then, the death of the assured, under the circumstances stated, the natural consequence of the injury? I think it was. I think it idle to suggest that there is anything in these circumstances which tends to show that the cold which led to the fatal attack of pneumonia was caught by the assured in some manner independent of the injury."

Held: "Within the policy."

[*Isitt v. The Railway Passengers' Assurance Company*, 1889, 22 Q.B.D., 504.]

### Negligence.

*Septic Pneumonia*.—LORD HALSBURY (*obiter dictum*): "An injury to the head has been known to set up septic pneumonia, and many years ago I remember, when that accident had in fact occurred, that it was sought to excuse the person who inflicted the blow on the head from the consequences of his crime because his victim had died of pneumonia, and not, as was contended, of the blow on the head. It does not appear to me that by calling the consequences of the accidental injury a disease one alters the nature or the consequential results of the injury that has been inflicted."

[In *Brintons Limited v. Furvey*, 1905, 92 L.T., 578; 1905, A.C., 230; 74 L.J., K.B., 474; 21 T.L.R., 444.]

### Workmen's Compensation Act.

*Pneumonia—Inference of Accident* (W.C.A.).—On March 11 a healthy man, regularly employed, went down a ship's hold to do his work at 1 p.m. At 3 p.m. he was seen to come out pale and in great pain. He made no official report, but was sent home. His doctor found marks of injury in his side over his ribs. Three days later he developed pneumonia, and died on March 19. There was no further direct evidence that there was an accident or that it happened at work. The County Court Judge found that there was an accident "arising out of and in the course of the employment."

On appeal, held there was sufficient evidence to justify the finding of the County Court Judge.

[*Loveday and others v. Berrie*, C.A., July 22, 1909; 2 B.W.C.C., 62.]

*Pneumonia, Chronic Bronchitis and Asthma, following an Injury to Knee and Long Cold Walk* (W.C.A., C.A.).—The applicant while employed in the respondents' colliery was injured by a stone falling on his knee. It was a cold day on which the accident occurred, and the applicant took over two hours to get to his home, a distance of a mile

and a quarter. Chest trouble and pneumonia supervened, which left bronchitis and chronic asthma, rendering him unable to work.

COZENS-HARDY, M.R. : "The test was not whether the man's condition was a natural result of the accident, but whether it was a result of the accident in the sense that it was occasioned by the debilitated condition of the man immediately after the accident."

[*Ystradowan Colliery Company v. Griffiths*, 25 T.L.R., 622 ; 2 B.W.C.C., 357.]

*Consumption (Tuberculosis of the Lungs) excited by Sprained Ankle (W.C.A.)*.—A workman sprained his ankle on November 28, 1908, but worked on till January 5, 1909, when he called in a doctor. He developed rapid consumption, and died on March 2, 1909. Many years ago he had suffered from tuberculosis of the lungs, and there was a conflict of evidence as to the degree of cure. He was considered a strong and healthy man by his fellow-workers, and before the accident used to play the cornet in a brass band, and had only two payments from his sick-club in sixteen years. The arbitrator found that the accident revived the tuberculous trouble from which he had previously suffered, and that this resulted in his death.

[*Davis v. The Point of Ayr Collieries*, 2 B.W.C.C., 157.]

*Pneumonia—No Accident (W.C.A.)*.—The deceased man was a meat porter in the Central Meat Market, and worked at night. He died from pneumonia on May 15, and his wife claimed that it was due to injury to the lungs.

The statements of the deceased man to his wife were wrongly allowed to be given in evidence, and as repeated by her at the inquest and at the arbitration differed in essential details.

The accident was claimed to have happened on May 11, but on the day before this he spat blood and said he felt ill. He went to work, and on his return after doing his night's work said he had broken a small rib.

It was agreed that the medical evidence given at the coroner's inquest should be read as medical evidence, and the following is the deposition of Dr. Ludwig Freyberger :

"I made a post-mortem examination of the body. No marks of violence. Internally, left lung adherent to chest wall by a recent fibrous deposit.

"Both lobes of lower lung granular and acutely inflamed.

"At the back of lower lobe of left lung opposite the ninth rib was a vertical tear in lung substance, a little over half an inch in length and a quarter of an inch deep. The edges of tear were swollen and turned up, and a handful of blood-clot in cavity of chest by the tear. No injury to the rib.

"Heart fatty and very soft. Liver, spleen, and kidneys cloudy swelling ; other organs healthy.

"The death is due to failure of the heart accelerated by acute inflammation of the lung and pleurisy while suffering from laceration and tearing of the lung.

"It could have been done in the manner described by the deceased."

His Honour, in giving judgment, said : "I am quite satisfied that the man died from the injury caused while he was carrying a weight,

and I am equally satisfied it was caused by carrying a side of beef, probably because it slipped and he jerked himself, and that that caused the accident, which did arise in the course of his employment."

From this decision the employers appealed.

COZENS-HARDY, M.R.: "This appeal must be allowed. The deceased man was a badge porter—a man who works in the early hours of the morning in the meat market, and who seeks and obtains employment in carrying meat from the Great Western trains to the meat market. He was undoubtedly in a very bad state of health. It is clear that on the Monday, the day before it was alleged he met with an accident, he was spitting blood. It is clear that, from the widow's evidence, on that day his wife thought he ought not to go out; contrary to her wish, he insisted on going out. . . . The evidence that he was spitting blood on the Monday renders it far more probable that if he had suffered any wrench or tear it was on the Monday and not on the Tuesday morning. There is nothing to connect the accident with the time when he was working for the company. There is nothing whatever to show that the accident happened when this man was in the employment of the Great Western Railway. I think the Judge was wrong. There was no evidence before the County Court Judge that this man ever met with an accident, or, if he did, that it arose out of and in the course of his employment with the Great Western Railway Company."

FLETCHER MOULTON, L.J.: "I am of the same opinion. In this case the only evidence on which the claimant rested her case consisted of these statements made by the deceased man as to his having had an accident and as to the nature of the accident. I can find no case that would authorize the admission of such statements in evidence. In cases of this kind we do give considerable latitude in admitting the statements of deceased persons under the head of what is called *res gestæ*. But to admit these statements in evidence would be to go far beyond what the Court has ever sanctioned and contrary to the English law."

NOTE.—As Dr. Freyberger did not give evidence and was not cross-examined, we presume that he meant the "tear" could have been caused by a strain; for if the man complained of injury to a small rib, that injury would hardly cause pneumonia on both sides to supervene the next day, nor was there in fact any injury to the rib.

[*Gilbey v. The Great Western Railway*, on appeal from Judge Lumley Smith, City of London Court, 3 B.W.C.C., 135.]

*Pneumonia; No Accident* (W.C.A.).—Langley, a workman, aged fifty-three, whose employment was to watch smacks, was, on June 20, 1909, in good health. He watched a smack all that night, and returned home the next morning, Monday, June 21, at 8 a.m., apparently in good health. He went out again at 8.15 a.m., returning after 1 p.m., when he complained of a pain in his side. *He told his wife "he had hurt his side in letting go a rope."* He went up to the hospital, and came back and lay on a sofa. He still had a pain in his left side. On June 22 and 23 he remained in bed. On Thursday, June 24, he began to cough, and his breathing became quick. On June 25 it was noticed that his spittle was tinted with blood. On

June 28 he again went to the hospital, where he died of pneumonia. The house-surgeon of the hospital to which he was admitted thought that the accident had nothing to do with the pneumonia; he found no signs of injury anywhere on his body, and thought that, though a direct blow on the chest could cause pneumonia, a strain could not do more than lower the vitality.

Dr. McCeath thought that if a man strained his left side, and four days afterwards developed pneumonia, it might arise from lowered vitality, and he considered that this pneumonia was contracted after the accident.

The varied statements alleged to have been made by the deceased man as to the nature of the alleged accident will be seen from the judgment.

The medical referee made the following remarks:

"The evidence, in my opinion, pointed to the deceased having contracted acute pneumonia on Monday, the 21st. That the onset of the illness was first shown by the acute pain in the side, which the deceased believed must have been due to having wrung himself. The loss of appetite, restlessness, loss of sleep, high temperature, 'tidily hot' and pain on the first night, all point to the onset of an acute illness."

The County Court Judge gave the following judgment:

"I hold that the deceased met with an accident arising out of and in the course of his employment, and that pneumonia supervening, he succumbed to it, such pneumonia being set up by the accident. The medical evidence for the defence—or, rather, the medical theory of the defence—is that the deceased mistook for a strain what was really a pain or spasm caused by incipient pneumonia. But this is only surmise, and I do not feel constrained to adopt it in preference to the man's own explanation and statement that he strained himself in letting go a rope—a by no means improbable event to one in his occupation.

"I am bound to admit that the official medical referee takes the view of the defence that the deceased mistook a pain arising from pneumonia for a pain arising from a strain. While giving great weight to that opinion, I do not feel bound to surrender my own judgment in the matter, and therefore decide in favour of the applicant."

COZENS-HARDY, M.R.: "I think we must allow this appeal, as there was no evidence before the County Court Judge of any accident resulting in the death of this workman. The workman died from pneumonia. He had complained of feeling a pain in his side. But for the admission of certain statements made by the deceased to three other persons, which was not objected to by the solicitor appearing for the employers, there would not have been even a vestige of any evidence that there had been any accident. He made these statements to his wife, his daughter, and to another person, but these statements were inconsistent with each other. He said that he had strained himself when jumping on board a smack, and again when letting go a rope, and again when not on board the smack at all. On no one of the occasions did he speak of having been injured by an accident. He spoke of feeling a pain. In my view, what he said did not amount to more than this—namely, that



when feeling pain, he said, 'I must have done this when jumping on board'; and, 'I must have done this when letting go a rope.' How can the Court say that there was more than a scintilla of evidence that this workman was injured by an accident arising out of and in the course of his employment? In my opinion, there was no evidence upon which the County Court Judge could have come to the conclusion that there had been such an accident. If there had been such evidence, I think Mr. Walter Stewart might have maintained this award. Because, though the medical referee took a different view, and though I should have taken a different view, yet, given that there had been such an accident, it would be difficult for us to say that there was no evidence that the pneumonia, from which the workman died, did not result from the accident. So I think the award must be set aside."

[Langley v. Reeve, on appeal from Judge Eardley-Wilmot, Lowestoft C.C., 3 B.W.C.C., 175.]

### MALINGERING AND EXAGGERATION.

When it has been found as a fact by the arbitrator that malingering exists or does not exist, his decision will not be disturbed by the Court of Appeal.

The majority of cases of malingering are simply dismissed, leaving the unfortunate master to pay the costs he has necessarily incurred in defending himself. These have amounted in some cases to several hundred pounds. The result is that most unsuccessful cases must be indicated indiscriminately under the head of "unsuccessful," and readers must draw from the nature of the evidence what conclusions they think fit, as to whether the applicant was malingering or not. (See below, Perjury, p. 1038.)

*Obiter Dictum in a Case of Traumatic Neurasthenia (W.C.A.).*—COZENS-HARDY, M.R., where the arbitrator expressly found the workman was not malingering, said: "I hope nothing that I say here will ever be supposed to give any countenance to malingering. But if the learned Judge had found that the man was malingering, the position, of course, would have been entirely the other way, and that would have been a question of fact for him, and we should not have interfered with the finding."

FARWELL, L.J.: "Of course it is exceedingly difficult for a County Court Judge in many cases to determine whether it is really a nervous complaint, or whether the man is shamming."

[Eaves v. Blaenclydach Colliery Company, 1909, 2 K.B., 73; 2 B.W.C.C., 329.]

**Paralysis One Side, Duration Three and a Half Years; Malingering alleged (W.C.A.).**—Roach had been working for twenty-four hours when he met with the accident; which he said incapacitated him for three and a half years, for which period he received compensation of sixteen shillings weekly. The employer then applied to terminate the award, alleging that the workman was now well.

The landlady and landlord of the house where Roach had lived between February and June of 1908 gave evidence that the man had not been at the house long before he was seen to use irons, chop up logs of wood, make a large birdcage, move a mangle 6 feet in length, build a cupboard, and perform other tasks which necessitated the use of both hands.

Further than this, Roach used to go out to look for work at the "White City," and about twelve months ago he knocked down a navvy outside a public-house.

Among the witnesses called was Professor Pepper, the Home Office analyst and expert, who said he was convinced that Roach was malingering. There were no indications of disease that would cause paralysis.

Dr. Harris stated that when Roach came under his attention nine years ago he was suffering from slight paralysis, but on examining him in December last he found that all traces of paralysis had disappeared. During the experiments which were made, he said that Roach fell down like a log, knowing that the witness would catch him. In a case of genuine unsteadiness the patient would make some effort to save himself.

On behalf of Roach, Dr. Dreaper said that he had been attending him intermittently for the past five months, and was of opinion that he was unfit for work as a labourer.

His Honour Judge Selfe decided to refer the case to a medical referee, with instructions to report to him on the case by December 22.

The medical referee made a report, and the consequence was that the workman did not succeed.

[*Neave and Sons v. Roach*, Judge Sir William Selfe, Marylebone, *Daily Mail*, December 2, 1908.]

**Intentional Injury to Eye—Negligence.**—The following is an interesting case communicated to the editor by Mr. Colam. It shows how far a malingerer will go when determined to obtain money by fraudulent means: The plaintiff claimed that he had been struck in the eye by an iron bar which had been negligently allowed to project from a house during some building operations. He said he was walking along the pavement, and the iron hit his eye. Shortly after the alleged accident he saw a doctor, and then his eye showed considerable inflammation. The true story was that he saw the bar, walked up to the fence placed round the house, and deliberately got over the fence, touched his face against the bar, previously looking round to see that nobody was looking. (He was unable to see witnesses the other side of the road who were in a room which overlooked the pavement.) He then went off to the chemist and procured a corrosive irritant (copper sulphate), which he put into his eye to produce the inflammation which he showed to the doctor. He produced a friendly witness who broke down on cross-examination, and, fortunately, the defendant was further able to prove the whole of this extraordinary plot.

**Exaggeration, and no Genuine Attempt to work (W.C.A.).**—In 1903 the applicant sustained an injury at the respondents' collieries. He was paid £1 per week until 1907, when light employ-

ment was given to him. He then said he suffered considerable pain and could not follow this light employment.

His Honour's award was in favour of the employers, on the ground that "The hysteria was exaggerated intentionally, and that the man might follow light work, and had never made a genuine attempt to do such work." The man appealed from this award.

The Master of the Rolls pointed out that some of the evidence was to the effect that if the man had been compelled to work he would have recovered. Fletcher Moulton, L.J., said he thought the neurasthenia could not be the result of the accident.

Farwell, L.J., asked if the evidence did not show that if the man had stuck to his work he would have recovered, but he gave up as soon as his heart failed him.

The Master of the Rolls, without calling upon counsel for respondents, said that there was ample evidence to justify the learned County Court Judge in his ruling.

[*Price v. Burnyeat, Brown and Co.*, by the workman, on appeal from Judge Bryn-Roberts, Pontypridd C.C., 2 B.W.C.C., 337.]

#### **Unintentional Exaggeration not Malingering (W.C.A.).—**

Conran, a workman employed by Messrs. Neill and Sons, injured his leg, and received compensation for incapacity for some weeks. At the end of this period his masters thought him fit for light work, and offered him various kinds of employment of a nature not unduly laborious. Watering concrete with a hose-pipe and watching by day at the gates were both too much for him, as they caused such pain in his injured legs, and even such swelling, that he refused to perform either duty. At the hearing of the arbitration, however, in spite of these troubles, the employers' doctor gave evidence that he would be the better for work.

His Honour said it was obvious that the applicant had got into such a mental condition that he had exaggerated his injuries to himself, and would not make a proper and reasonable effort to get better and go back to work. Unless some pressure were put on him, he would not cure himself. It was one of the cases in which the Workmen's Compensation Act was an injury instead of a benefit to the workman, because as long as he could go on drawing money he was kept in such a condition of mind—although not dishonest or malingering—that he would not get to work again. In the circumstances the Judge merely made a declaration of liability, and no order as to costs.

[*Conran v. Neill and Sons, Manchester C.C.*, Judge Parry, October 14, 1908, *Policy Holder*, xxvi. 809.]

**Malingering (W.C.A.).—**Carter, a workman employed to drive the engine of a steam-winch, had led a healthy life, earning £2 5s. weekly until he met with an accident. He had served as engineer on board one of Her Majesty's ships in the tropics, had been through the Egyptian campaign; and had never, he said, had a day's illness. On July 20, 1907, when pulling over the lever of his engine, he slipped, and the point of the handle struck him on the right side over the liver. He claimed compensation under the Act for total incapacity, due to pain in the injured spot, diarrhoea, vomiting, night

sweats, loss of weight, nervousness, tremors of the hands, sleeplessness, and blood in his motions.

The Judge thought the evidence difficult, but, on the admissions of the doctors for the employers, found that the man had traumatic neurasthenia, and awarded him £1 weekly. This compensation he drew until December 16, 1909, when it was stopped by the Judge on the grounds that the man was grossly malingering. At this date, and for a long time before, he had complained of irregular vomiting, diarrhœa from four to seven times daily, pains on both sides (localized to one spot on the right, but diffuse on the left), sleeplessness, a cloudy feeling in his head, nervousness and inability to keep his attention to his work, with weakness and loss of power generally. His legal advisers refused to act or appear for him unless he went into one of the large London hospitals, under the care of an independent and consulting physician, who, after a careful examination of him, would report on the condition the man was in. This was done, and after most careful observation, testing, and watching, for ten days, the report was that there was no sign of any disease in any part of his body, and much deliberate exaggeration of all the symptoms; that the vomiting was intentional, but done to relieve the unpleasant feeling in the stomach; but that, in spite of all the exaggeration, there was a definite quota of real neurasthenia attributable to the original injury.

Dr. Collie (the author of the article on Malingering, above, p. 545) was called for the employer, and described the tests which he applied to the man. "The examination," Dr. Collie said, "lasted one hour, and was commenced to the accompaniment of groans, which ceased as time went on." Three times he deliberately and intentionally tried to vomit, was twice told to stop by Dr. Collie, but at length succeeded in bringing up a small quantity of fluid. He was a fat, healthy man, in a condition quite incompatible, Dr. Collie thought, with frequent vomiting, and with the diarrhœa, four to seven times daily, of which he complained. Tested with Romberg's test—the feet together, the hands by the side, and the eyes closed—he at once fell straight forwards, and was caught by Dr. Collie, who told him to repeat the test, adding, "If you fall, I shall not catch you." This time he did not fall, and only swayed a little. His eyes were tested for light and accommodation, his hands being by his side and his feet together. Whilst in this position he was told to close his eyes; he did not realize that in doing so he supplied Romberg's test, and did not stagger or sway. A painful spot was indicated by him on the right side, and was marked by Dr. Collie; after a short interval of time it was again indicated, this time in a fresh locality. This was repeated, and a third area for the painful spot was found. The tenderness of the left side caused much protest on Dr. Collie handling it, producing great expressions of pain from the man; but when the chest was being forcibly percussed to examine the state of the lungs, no complaint was made of the tenderness. Though acutely tender to touch, it was not tender to the pressure, firmly applied, of the stethoscope. During the examination the left hand started to tremble, but when Dr. Collie went behind the man this suddenly stopped, when it seemed out of sight of Dr. Collie.

His Honour refused to accept presence of any true neurasthenia

at all, and found it to be a gross case of malingering and an attempt to obtain money by false pretences; but he held that a proper course had been taken in sending the man to the hospital for observation, and that the legal and medical advisers of the workman were free from any blame.

[*Moran v. Carter*, Lambeth C.C., Judge Emden, December 16, 1909. Unreported (?).]

**Arm—Amputation** (W.C.A., “bogus” claim).—The applicant claimed that on December 11, 1905, she was employed as a rope packer in the respondents’ employ, and while she was in the act of taking a hook from one of the bales, the hook swung round forcibly and struck her on the back of her left hand. She was hurt, but managed to keep at her work for seven weeks. Then her hand began to swell as a consequence of the blow which she had sustained. It grew worse, and eventually the arm had to be amputated at the elbow. She had now been advised to have the remainder of the arm amputated. In her evidence, the applicant stated that she acquainted the respondents with the injury she had received immediately after the accident, and also when she was going into the hospital for treatment. When she spoke to the foreman, he made fun of her and told her to go back to her work. . . .

. . . She admitted that in 1902 she went to Ancoats Hospital and underwent an operation to her arm. . . .

. . . A number of witnesses were called, and the wage books of the firm were produced to show that the woman was not in the firm’s employ at the time she alleged. The witnesses stated that it had been known in the works for years that the woman had a diseased arm, and the foreman said she had told him it had been bad from childhood.

After a long hearing, His Honour said he found on the facts that the applicant was not in the respondents’ employ at the time of the alleged accident, and moreover that there never was such an accident. The woman’s story was an extraordinary one, and it was absolutely without any foundation whatever. The whole claim had been properly described by Mr. Elliott as a bogus one. He gave an award for the respondents with costs.

[*Bevins v. Pettitt and Company, Policy Holder*, xxvi. 860.]

### Unsuccessful Claims.

In the following cases a claim failed to establish, either that the alleged injury arose at all, or that it produced the consequences attributed to it.

Some of them are perfectly honest mistakes on the part of the plaintiff, reasonable mistakes which any layman might make. We cannot here differentiate between malingering and honest errors, they even merge into each other, but in some of the following cases it will be seen, that though the judge merely gave a judgment for the defendant or made an award in favour of the respondents (employers), yet the claim was absolutely fraudulent:

*Rayman v. Fields*, p. 883; *Whittle v. Ardley*, p. 885; *Smith v.*

Canadian Pacific Railway, p. 880; *Nawson v. s.s. Montrose*, p. 929; *Southward v. Oxhey*, etc., p. 942; (*Dr. Lister's case*), *Kidneys*, p. 987; *Brown v. Saunders*, p. 1038.

## MEDICAL MAN.

1. The duties and liabilities of the medical attendant with regard to his patients. Contract and Negligence (civil, criminal), and other torts; professional services.
2. The duties and liabilities of the doctor for the defendant or respondent.
3. The expert witness :
  - (a) Subpœna.
  - (b) Privilege.
  - (c) Notes.
  - (d) Evidence. (Medical evidence is mere opinion.)
  - (e) Certificates and reports.
4. Fees :
  - (a) Payable to the doctor for medical attendance.
  - (b) Medical expenses recoverable as part of special damages or compensation — (i.) During the lifetime of the plaintiff, claiming for negligence, breach of contract or under W.C.A. (ii.) After his death: tort; contract; W.C.A.
  - (c) Amount of fees.
  - (d) Official fees.
5. Official medical men under W.C.A.

### I. The Duties and Liabilities of Medical Attendants with Regard to their Patients.

The position of the doctor is usually that of one of two parties to a simple contract. This may exist between the doctor and the injured person, or between the doctor and some other person who has contracted with him to attend the sick person. This latter contract may be direct, as where the husband, father, or master, engages the doctor to attend wife, child, or servant; or implied, where the wife or child, being insufficiently supplied with "necessities," which include medical attendance, engages a medical man. The contract in this case will of course be, not between the wife or child and doctor, but between the husband or parent and doctor for whom the wife or child was acting as "agent of necessity."

The duty of the doctor is to give due professional skill according to the terms implied by his holding himself out as a doctor. Failure on his part will render him liable for damages arising out of his breach of contract. If the contract was with a third party for attendance on a sick person who suffers through his lack of proper care and skill, the doctor may then be liable to an action for damages for negligence, or absence of due professional skill, at the suit of the sick person.

Professional skill is impliedly guaranteed by professional men, and so a far higher degree of care is exacted from the man who holds himself out to be a surgeon than would be expected from a policeman who rendered "first aid." The policeman might do a great

deal of harm with his first aid—for example, by bandaging a wounded varicose vein between the wound and the heart—and yet he might not be liable for negligence; but if a Sir James Paget does this and the patient suffers, he will be liable for definition, or the careless practice of his profession. Included in the quality of such negligence is ignorance of a profession which the surgeon holds himself out to possess.

The Medical Act prohibits anyone who practises without qualifications from suing for his fees, but it does not alter the law of liability of practitioners for malpractices, so that an unqualified person holding himself out as able to cure may still be liable for damages for malpractice. (See below, *Jones v. Fay*.)

If the negligence is alleged to have caused the death of the patient, then the doctor may be charged with manslaughter, but he will be acquitted unless he has been guilty of the grossest carelessness. There is no other special feature of medical negligence, except that it is a claim against a doctor that is rarely raised till the bill is sent in.

*Medical Attendance may be a "Necessity" to a Wife, and even if the Money is borrowed to pay for this, it can be recovered from the Husband.*—J. S. had given his wife the foul distemper twice, upon which the wife, leaving her husband and coming to town to be cured, borrowed £30 of the plaintiff to pay doctor and surgeon and for necessaries.

JEKYLL, M.R.: "This money being applied to the use of the wife for her cure and for necessaries, the plaintiff, who lent this money, must in equity stand in the place of the persons who found and provided such necessities for the wife."

Held: "The plaintiff can recover the money."

[*Harris v. Lee*, 1718, 1 Peere Williams, 482.]

*Confinement; Proper Skill and Care—Negligence.*—The male plaintiff engaged the defendant to attend his wife during her confinement. After many attendances, nine in all, extending over some days, the child was eventually born, but dead. Before the birth of the child, the plaintiff had dismissed the defendant and called in another medical man, who disagreed with the treatment of the defendant.

The plaintiff made various charges against the defendant, which amounted to the real cause of action, that he "did not use due skill and care in his capacity of accoucheur."

ERLE, C.J.: "A medical man was certainly not answerable merely because some other practitioner might have shown greater skill and knowledge, but he was bound to have that degree of skill which could not be defined, but which, in the opinion of the jury, was a competent degree of skill and knowledge. . . . It was not enough to make the defendant liable that some medical men, of far greater experience or ability, might have used a greater degree of skill, nor that even he might possibly have used some greater degree of care. The question was whether there had been a want of competent care and skill to such an extent as to lead to the bad result. . . . The medical evidence appeared to be greatly in favour of the defendant; and considering how much the treatment of a case depended upon its varying phases, which changed as quickly as the shifting hues of the heavens, it was hard for one medical man to

come forward and condemn the treatment of a brother in the profession, and say that he would have done this or that, when, probably, had he been in a position to judge of the case from the first, he would have done no better."

The jury found the defendant was not guilty of such want of due care or skill, and gave a verdict in his favour.

[*Rich et Uxor v. Pierpont, Erle, C.J.*, and jury, Surrey Assizes, 1862, 3 F. & F., 35.]

*Treatment ; Degree of Professional Skill ; Injury to Arm—Negligence.*—The female plaintiff, trying to avoid a cow of which she was frightened, stumbled and fell, injuring her arm. Her husband, the male plaintiff, called in the services of the defendant to cure the injury, as to the exact nature of which there was some dispute, but which appeared to have been a fracture of one of the bones of the arm and a dislocation of one of the bones of the wrist.

The surgeon put the arm up in splints, leaving the wrist hanging down and the hand unsupported by any splint. After seven weeks, during which there was continuous swelling and pain, the plaintiff dispensed with the services of the defendant, and, calling another surgeon in to tend the wife, brought an action for damages.

The wrist of the lady was partially disabled, as she could not hold either knife or fork, nor could she dress herself.

The law of the case was stated as follows :

TINDAL, C.J. : "Every person who enters into a learned profession undertakes to bring to the exercise of it a reasonable degree of care and skill. . . . Nor does a surgeon undertake that he will perform a cure ; nor does he undertake to use the highest possible degree of skill. There may be persons who have higher education and greater advantages than he has ; but he undertakes to bring a fair, reasonable, and competent degree of skill."

[*Lanphier v. Phipos*, 1838, Tindal, C.J., and jury, 8 C. & P., 475.]

*Bleeding by an Apprentice ; Unskilfulness (Damages).*—The plaintiff went to the defendant's surgery to be bled. He was bled by the apprentice of the defendant, and returned home. His arm afterwards swelled up, and he was ill for some time, for which he claimed damages.

TINDAL, C.J. : "A surgeon does not become an actual insurer ; he is only bound to display sufficient skill and knowledge of his profession. . . . The plaintiff must show that the injury was due to want of skill ; you are not to infer it."

Verdict for the defendant.

[*Hancke v. Hooper*, 1835, Tindal, C.J., and jury, 7 C. & P., 81.]

*Responsibility of Surgeons for Nurses.*—Two surgeons of St. George's Hospital ordered a hot hip-bath for a patient. It was not their duty to supervise the bathing. The nurse carelessly gave the bath too hot. The patient was scalded and claimed damages. The plaintiff swore that he screamed, and that the surgeons must have heard him. They swore they did not hear anything of the kind.

COCKBURN, C.J. : "It was indispensable that such matters [as baths] should be left to the nurses, who were familiar with them. It had been satisfactorily proved . . . that such was the ordinary



and usual course of hospital practice. . . . The defendant would not be liable for the negligence of the nurses unless near enough to be aware of it and to prevent it."

It was contended for the surgeons that they were not liable, and if anyone was it was the nurses themselves, and the hospital authorities who employed them.

Held: "The plaintiff was not entitled to expect more than the usual and ordinary degree of care and attention at the hands of the surgeons, and if they were not personally cognizant of the alleged ill-usage they were not liable."

[*Perinowsky v. Freeman and others*, 1866, Q.B., Cockburn, C.J., and jury, 4 F. & F., 977.]

*Responsibility of the Hospital for Doctors.*—It has recently been decided that the governors of a hospital are not liable for the negligence of the medical and surgical staff.

[*Hillier v. The Governors of St. Bartholomew's Hospital*, 1909, 25, T.L.R., 762.]

*Wrong Treatment by an Unqualified Man who "undertook to treat the Plaintiff for his Disorder."*—The plaintiff appeared to have been suffering from painter's colic, and he called at the shop of the defendant, who was a chemist and not a qualified apothecary, but who undertook to heal him. For some three weeks he treated the plaintiff with mercury pills, which caused great salivation and made him worse, but still the defendant dissuaded him from seeing a doctor.

It was held to be unnecessary to allege that he was retained as *surgeon and apothecary*, for if he assumed to act as "surgeon and apothecary" he was liable as such. These words, though in the pleadings, were held to be immaterial, as the defendant undertook to treat the plaintiff for his illness, and did so negligently and ignorantly.

Damages £100.

[*Jones v. Fay*, 1865, Surrey Assizes, Pigott, B., and jury, 4 F. & F., 525.]

*Professional Skill: Criminal Liability for Want of Skill.*—"Every medical man was of course liable to make a mistake, and he would not be criminally responsible for the consequences. . . . It was only in the case where a medical man . . . was guilty of gross negligence, or evinced a gross want of knowledge of his profession, that he could be held criminally responsible."—Note of charge of the Recorder in a case at the Central Criminal Court, where a man was charged with manslaughter of a woman by his negligent conduct during a confinement (1862, 3 F. & F., at p. 41).

*Unqualified Practitioner; Dangerous Medicine; Death—Manslaughter.*—The prisoner, who was a herbalist, prepared a large dose of colchicum-seeds for a girl who had pains in her back. A few days after she died of acute gastritis, alleged to be due to the colchicum. The normal dose of colchicum is 2 grains at a time; she was given 18 grains.

WILLES, J.: "A person who so took a leap in the dark in the administration of medicines was guilty of gross negligence. If a man

were wounded, and another applied to his wound sulphuric acid, or something which was of a dangerous nature and ought not to be applied, and which had fatal results, then the person who applied this remedy would be answerable, and not the person who inflicted the wound, because a new cause had supervened. But if the person who dressed the wound applied the proper remedy, then, if a fatal result ensued, he who inflicted the wound remained liable. He left it to the jury to say whether on the evidence the deceased had died from natural causes, or from the supervening cause of the medicine prescribed for her by the prisoner, he being an irregular and apparently unskilled practitioner."

[Reg. v. Markess, 1864, 4 F. & F., 356.]

**Professional Secrecy.**—There has been since the earliest times—witness the declaration of the Scottish graduates and the oath of Hippocrates—a duty not to disclose the information gained by attendance on the sick. The duty arises out of the contract, of which it is an implied term, so that, where the contract is with someone other than the sick person, disclosure to that person may not be actionable. For example, where a mistress, suspicious of her servant's chastity, calls in a medical man to examine the servant, who, knowing the position, submits willingly to the investigation, then the doctor can inform the mistress of the truth. But to no one else should he give the information; in the witness-box, however, he is compelled to disclose it.

In Scotland, the disclosure by a medical man of the secrets he has discovered or been told in virtue of his professional position may or may not render him liable to an action for damages, according to the character of the disclosures made. (See *A. B. v. C. D.*, 1905, 7 F., 72., affirmed on this point, *Watson v. McEwan*, 1905, A.C., 480.)

For the position of the expert witness, see below, Privilege, p. 1007.

*Professional Secrecy—Damages* (Scottish).—The plaintiff's wife, some six months after her marriage, had a child born, which caused a scandal in the Church, and the matter was then inquired into, to find out if the conception was antenuptial. Two medical men, on behalf of the husband, saw the child, and gave an adverse report, which was through their carelessness made public. The question for the Court to decide was whether the disclosure was actionable.

THE LORD PRESIDENT: "It is specially stated that these two medical gentlemen were confidentially employed. I cannot shut my eyes . . . that it was a confidential employment, and that the confidentiality was infringed on."

LORD FULLERTON: "It is true that privilege—*i.e.*, the right, or rather the duty, of a party called as a witness to decline giving evidence on the score of confidentiality—is limited to the professional relationship of agent (solicitor) and client. But it does not follow, from the absence of privilege in other professions, that there is no binding obligation to secrecy, which, if violated, may be the ground of action."

LORD IVORY: "It would be a most serious thing to admit the argument . . . that there is no confidentiality between a medical man and his employer. Suppose this lady had not been married,

and the defendant had been called in to attend her accouchement, could he have published that with impunity? If it could ever have been doubted that such a confidential relationship subsists between a medical man and his employer, I think it high time that such a doubt should now be set at rest for ever."

[A. B. v. C. D., Court of Session, Scotland, 1851, 14 D., 177.]

## 2. The Duties and Liabilities of the Doctor for the Defendant or Respondent.

Independently of such restrictions as are imposed by the Workmen's Compensation Act and other like Acts, there is no statutory or Common Law obligation on anyone to be examined by a doctor.

If the examination is permitted, and is conducted decently and with the consent or voluntary submission of the person, then there is no ground of action for assault. But if threat, violence, or force be used, then such action lies.

A fee for the man's own doctor is often demanded by the legal advisers of the injured man for the "consultation." There is no legal obligation to pay this fee, and the consultation is often more an obstruction than a help on the part of the brother practitioner, who may get useful hints from the method of examination, and rarely if ever imparts any useful information.

For the position under the W.C.A., *vide infra*, Devitt and Crossby v. Owners of s.s. *Bainbridge*, p. 1007.

*Examination for Suspected Pregnancy—Unsuccessful Action for Assault.*—A servant-girl in the employ of Captain and Mrs. Bradell was suspected by them of being pregnant, so they called in Dr. Sutcliffe. "The plaintiff objected to the examination, but undressed by the doctor's orders and submitted to the examination. The doctor examined her and ascertained that she was not pregnant. He used no violence or threats, and did nothing more than was necessary for the examination."

She then sued the master, mistress, and doctor, for assault.

Held (on appeal): "There was no evidence against the master or mistress, and the verdict in favour of the doctor was right."

BRAMWELL, L.J.: "Very likely the plaintiff thought the defendants had a right to have her examined; but the truth is, she submitted to it, and it is impossible to say the jury were wrong in finding that she submitted. She may have submitted under an erroneous notion of the law, but it was not through fear of violence."

BRETT, L.J.: "The doctor could only be liable if he did what he did without the consent or submission of the plaintiff; and Captain and Mrs. Bradell could only be liable if they authorized the doctor to do what he did, and he did it without such consent or submission. . . . To make out an assault by Dr. Sutcliffe, the plaintiff must show that he used violence, or that she had reasonable cause to believe that he was threatening violence."

[Latter v Bradell and Wife and another, 1881, 50 L.J., Q.B., 448.]

*Examination by Medical Man on a Magistrate's Order; Concealment of Birth; Assault.*—Annie Agnew was arrested on a charge of conceal-

ment of birth, and, denying it, was examined in the prison, on instructions from the police, by a medical man, in spite of her many protests. The examination was incomplete, and the doctor, to protect himself, demanded a magistrate's order, and then again examined her, in spite of further protests. Between the two examinations she had confessed to the charge. After the trial she brought a civil action for damages for an assault. The jury found the examination was made without her consent, and gave a verdict of £50 damages.

[*Agnew v. Jobson and others*, 1877, 13 Cox, C.C., 625.]

### The Workmen's Compensation Act, 1906.

*Before any Notice or Claim is made.*—Here, though the master may strongly suspect that a claim will be made, the workman is not bound to submit to an examination; it should not be objected to, and is rarely refused.

*After Notice of an Accident.*—Here the man must submit to examination or be held not entitled to compensation. "Where a workman has given notice of an accident, he shall, if so required by the employer, submit himself for examination by a duly qualified medical practitioner, provided and paid by the employer, and, if he refuses to submit himself to such examination, or in any way obstructs the same, his right to compensation, and to take or prosecute any proceeding under this Act in relation to compensation, shall be suspended until such examination has taken place."—Schedule I (4).

*During Receipt of Compensation.*—He must also submit to examination from time to time. "Any workman receiving weekly payments under this Act shall, if so required by the employer, from time to time submit himself to examination by a duly qualified medical practitioner, provided and paid by the employer. If the workman refuses to submit himself to such examination, or in any way obstructs the same, his right to such weekly payments shall be suspended until such examination has taken place."—W.C.A., 1906, Schedule I (15).

The above examinations are subject to regulations drawn up by the Secretary of State.

Regulations were made on June 28, 1907, which are—

1. Examination shall be "at reasonable hours."
2. After the first month he shall not be required to submit himself for examination by a medical practitioner provided by the employer except at the following intervals: during the second month, once a week; from the third to the sixth month, once a month; afterwards, every two months. A further examination may be held if any application has been made for a review.

*Official Examinations: (a) Industrial Disease.*—Until the sufferer from an industrial disease has obtained a certificate from the certifying factory surgeon, he is not entitled to any compensation.

*(b) Medical Referee.*—There are various sections of the Workmen's Compensation Act which provide for the examination by the

medical referee, usually at the place appointed by the referee, and not necessarily at the patient's own home, though, if he be too ill to travel, the Registrar of the Court may arrange for the examination to be at the man's home.

*Notice of Examination—Appointment not Necessary* (W.C.A.).—Under the Workmen's Compensation Act there is no need for the workman to have any notice of the intention to examine; at least, that is the opinion of His Honour Judge Mulligan. A complaint was made at Swaffham County Court, during the hearing of a workman's compensation arbitration, that the doctor for the respondent had made a surprise visit. His Honour said that the doctor acted quite properly, and that such visits might be necessary when malingering was suspected.

[*Purse v. Hayward*; Swaffham C.C., Judge Mulligan, 125 L.T.J., 10.]

*Obstruction to Examination; Demand by the Workman for the Presence of his Own Doctor.*—"If a workman refuses to submit himself to . . . examination, or in any way obstructs the same, his right to . . . weekly payments shall be suspended."—W.C.A., 1906, Schedule 1 (14).

A workman in receipt of compensation was requested by his employers to submit to medical examination. He said he would not be examined at the time when the employers' medical man called, but would submit if the doctor called later on in the day, when his own medical man would be there.

Held: "This was not a refusal to submit to the examination, within the Act."

[*Devitt and Crosby Magee v. Owners of s.s. Bainbridge*, 2 B.W.C.C., 383.]

### 3. Expert Witnesses.

(a) **Subpœna.**—A subpœna, being an order of the Court, must be obeyed; but it must be correctly served, accompanied by the proper fee and "conduct money"—the right travelling expenses, if any.

Some County Court Judges have held that a professional man is entitled to some reasonable notice—at least twenty-four hours—and have allowed a surgeon summoned at shorter notice to disregard it.

If a surgeon appears late at the court, and so delays the proceedings, the Judge may fine him for contempt of Court. But a subpœna is often abused, and may be disregarded at peril.

If a witness fails to appear when subpœnaed, he is guilty of contempt of Court, and also an action will lie against him at the suit of the party who has subpœnaed him, to recover any damage caused by the loss of his evidence. There may be cases where the absence of one witness clearly loses the case for a party, but it is obviously so difficult to prove this, that such actions never occur in practice.

(b) **Privilege.**—All that is said in the witness-box is privileged, and cannot be made the subject of an action for slander. (See above, Secrecy.)

*Statements made to a Solicitor by Expert Witness for the Purpose of his Proof—Privilege.*—Mrs. McEwan wanted to get a separation from her husband. She consulted a doctor, Sir Patrick Watson, who

afterwards again saw her on her husband's behalf, with a view to giving evidence against her in favour of the husband. He made a report to the solicitor, which Mrs. McEwan said was partly based on his former examination when acting on her behalf, and which she complained of as being libellous and a breach of professional secrecy under Scottish law.

Held: "The communication is absolutely privileged."

LORD HALSBURY: "By complete authority, including the authority of this House, it has been decided that the privilege of a witness, the immunity from responsibility in an action when evidence has been given by him in a court of justice, is too well established now to be shaken. Practically, I may say that in my view it is absolutely unarguable; it is settled by law, and cannot be doubted. . . .

"It appears to me that there is but one point in this case—namely, whether the preliminary examination of a witness by a solicitor is within the same privilege as that which he would have if he had said the same thing in his sworn testimony in court. I think the privilege is the same, and for that reason I think these judgments ought to be reversed."

[*Watson v. McEwan*, H.L., 1905, A.C., 480.]

(c) **Notes.**—Notes made at the time of the occurrence—*e.g.*, an examination—can be used to "refresh the memory" in court. But if they be so used, the opposing counsel has the right to look at them.

(d) **Evidence (Value and Conclusive Nature of)**—*Final Judgment.*—Where a final judgment or award has been given, then the medical evidence, no matter how faulty it is, cannot be set aside; and if injustice be done, it is permanent in the absence of a new trial.

*Agreement.*—In the same way, an agreement based on honest but erroneous medical opinion is also final, though it must be registered under the W.C.A.

*Final Award; Mistake of Opinion; Final Discharge as Full Settlement of Claim* (W.C.A., Scottish).—An injured workman, who was still suffering from the effects of the accident, was told by employer's servant that the employer's doctor said he would be well in a further two weeks, and asked him to sign an agreement in full discharge for four weeks' pay. He signed the agreement. The employer's doctor had made such a statement, but in fact his opinion turned out wrong, as the workman was not able to work for four months after the signing of the agreement.

Held: "No misrepresentation made by anyone."

The LORD JUSTICE CLERK: "What was represented to him was true—*viz.*, that the doctor was of certain opinion. I cannot hold that, where a doctor gives an opinion on which parties act in compromising a case for a certain sum, the fact that his opinion proves to be erroneous entitles a party to set aside the settlement made, on the ground of essential error. I am unable to see any distinction between this case and the case of *Wood*" (18 R., H.L., 27).

LORD TRAYNER: "But essential error, to form a ground of reduction, must be error induced by misrepresentation or undue concealment on the part of the person in whose favour the deed sought to be reduced was granted."

LORD MONCRIEFF: "There is no question here of the *bona fides* of the appellants in accepting the discharge from the respondent . . . In order to succeed in reducing the discharge granted by the respondent, he must show that it was an implied condition of the contract that Dr. Mechan's report should ultimately prove to be well founded."

[*Dornan v. Allan and Son*, 1900, 3 F., 112.]

*Open Award.*—As long as an award is open—that is, the liability of the employer is still subsisting—the medical evidence throughout the entire case can be again questioned, rebutted, supported, overthrown, and re-established. As often as either party cares to run the risk of losing costs he can, immediately after an award, apply for a review, and attempt to upset the opinion of the arbitrator by offering new medical evidence. "Medical evidence" in the view of the Court of Appeal "is mere opinion."

*Medical Evidence can always be contradicted as long as there is an Open Award.*—Compensation was awarded to a workman, but at the hearing of the arbitration, though it was admitted on both sides that the man was suffering from traumatic neurasthenia, the arbitrator came to the conclusion that this illness was of a temporary nature, and suggested a review at an early date. Some six months afterwards the employers applied for a review, but they were now met with evidence that, in addition to the neurasthenia previously proved, the workman was suffering from a definite injury to his brain, the locality of which was indicated by an eminent nerve specialist, Dr. Hyslop, of Bethlem Hospital. The employer's specialist denied the existence of this injury, but the arbitrator accepted Dr. Hyslop's evidence and continued the full compensation. Five months after the employers again applied for a review, saying that the man was now fit to work, and that Dr. Hyslop's diagnosis was wrong. The arbitrator refused to hear this evidence, as the matter had already thoroughly been gone into at the last hearing; but the Court of Appeal held that the arbitrator is bound to hear all the evidence again, as the only question before him is the man's capacity to work at the time of the hearing.

The only evidence that was in fact tendered, was expert evidence, and the following is the judgment of the Master of the Rolls:

COZENS-HARDY, M.R.: "There was an admitted accident. On an application to review the payments which were being made at the time, it came before the learned County Court Judge in October last. He then heard evidence and decided that the man was not able to work, and dismissed the application. No one seeks to challenge or impugn that; but the employers made a fresh application, as they are entitled to do, by the plain language of the Act of Parliament, and that came before the learned County Court Judge in March, 1909. What was the issue then? Aye or no. Is the workman, at the date of this application in March, 1909, or is he not, wholly or partially incapacitated from work? Then it is said—and this is the view that commended itself to the learned Judge—that he ought not to hear any evidence, and in fact he rejected any evidence, which might go to point that part of the evidence given in October was inaccurate; and it was suggested that the doctrine of estoppel

somehow applies, not merely in the sense that the parties are bound by the judgment given between the parties, but that there was an estoppel on the point of evidence. . . . The issue which alone was for decision by the learned County Court Judge in the present case was, Aye or no, what was the man's condition in March, 1909? . . . But I really think this is a point which is covered by authority which would bind us even if I did not feel disposed to agree with it. In the case of *Sharman v. Holliday and Greenwood, Limited* [6 W.C.C., 147], there is a very clear and emphatic decision on that point. Lord Collins says: 'I have grave doubts whether the doctrine of estoppel by judgment ought to be extended to a case of this kind, where the decision of the County Court Judge on the first occasion was on a matter which was merely one of opinion—namely, whether the workman was in such a condition at a particular time as to be incapacitated from working in future. It may be a question which in many cases can only be conclusively decided by experiment, and in such a case, until it is so decided, the clearest opinion on that question on the part of the Judge is founded merely on the evidence of experts, which may be displaced by the test of subsequent experiment. I can conceive a case in which the opinion of medical experts might be unanimous to the effect that a workman was capable of doing certain work, and yet afterwards, upon his attempting to do it, he might find it impossible.' Far be it from me to say that the learned County Court Judge, after hearing the evidence tendered, ought not to be greatly influenced by the fact of a conflict of medical opinions, and it may be the inconsistency of the view taken on both sides; but that the learned County Court Judge can exclude evidence of this kind is a proposition which I cannot support. In my view this appeal must be allowed, and the case must go back to be further heard by the learned County Court Judge."

[*Mead v. Lockart*, 2 B.W.C.C., 398.]

*Medical Advice.*—In spite of the fact that the Courts regard medical evidence in Workmen's Compensation cases as mere opinion, and as not final as long as an award is open, yet the private advice which is given to an injured workman is final, for it firmly establishes him as a "reasonable man." The matter has been fully dealt with in the section on Operation, p. 28, where it will be seen that, though a workman in refusing a simple operation which would restore him to working efficiency must behave "reasonably," yet if that refusal is made on the advice of any one medical man, the "reasonableness" of the workman cannot be questioned.

Even if only one doctor out of two on the workman's side advises against the operation, that is enough.

[*Ruabon Coal Co. v. Thomas*, 3 B.W.C.C., 33.]

For the classic illustration of the advice clearly establishing the reasonableness of refusal, see above: *Bones* (*Rothwell v. Davis*, p. 889).

The legal position is that a doctor's evidence may not be final, but that his advice as to operation is; his diagnosis as to the nature of the results of an accident binds neither the workman nor the employer.

(e) **Certificates and Reports.**—Certificates and reports are of various kinds.



(i.) *Hospital and Private Certificates.*—These are often given with a careless regard to the fact that a signature of the certifier is attached to them. The response to the demand for certificates is a heavy part of the duties, especially, of club doctors and hospital surgeons, and in most cases no payment is made for them. The following are instances of the value of some such certificates.

*Expert Evidence ; Certificates.*—The man's doctor told him that he was cured on September 24, but the doctor after that gave certificates of unfitness on October 2 and 9, and admitted in cross-examination that he was very careless about signing the notes, and that he very often signed them in a bunch.

[White Star Line v. Barnes, 1908, *Post Magazine*, p. 999.]

(ii.) *Official Reports and Certificates.*—These are numerous, and require no mention here, except those given by the certifying factory surgeon, medical referee, etc., for which see Official Medical Men.

#### 4. Fees.

(a) **Fees payable to the Doctor for Medical Attendance.**—The fees are either those agreed on between the contracting parties, whether the contract be between the doctor and patient or some other person, or the usual and reasonable fees will be considered as agreed on. If the attendance is on a wife or child, as already mentioned, the husband or father may be liable, as the wife or child may be held to be the agent of "necessity" for the husband or father, subject to the rule as to what are necessities in each case. The terms of the contract must be strictly carried out, and a master who asks a doctor to attend a sick servant on one occasion will not be liable to pay for all future attendances unless it is proved that the master made a contract to that effect.

After death of the patient, the fees are payable out of the estate of the deceased, and are not preferential payments.

(b) **Medical Fees as Special Damages during the Lifetime of the Patient.**—In actions at Common Law, for breach of contract or negligence, or under the Employers' Liability Act, medical expenses are a matter usually claimed as "special damages."

The injured person, or other person liable to the doctor for the fees, is the only person who can sue for them. If a person other than the injured man has agreed to pay to the doctor the fees, then such fees cannot be recovered by the injured man as his special damages, as they do not affect him. This applies even where an infant sues for damages by his next friend—*e.g.*, his father—who has paid for his medical attendance. For unless the fees were paid out of the personal estate of the infant, they are no loss to the infant, and so cannot be sued for by him.

*Infant sues by Next Friend—Expenses of Cure may not be recoverable by Infant.*—An infant sued for damages caused by personal injuries. The claim included special damages rendered necessary by the injury. It was found that these had been paid by the father and did not affect the infant's estate.

[*Collins v. Lefevre*, 3 F. & F., 436.]

*Under the Workmen's Compensation Act.*—No fees whatsoever are capable of being recovered by the injured man from the employer under the Workmen's Compensation Act, not even the fees of the certifying factory surgeon. The injured workman has to pay all his own medical expenses, including even the expenses of the operations which may be necessary for his cure, among which is the "statutory operation" for glass-blower's cataract. (See Operation.)

Fortunately the hardship in most cases is small, as nearly all serious cases are treated in hospitals which are largely supported by employers of labour, or were founded by them in the past. Fees and expenses paid by the employer may be a "benefit received by the workman" within the meaning of Schedule 1 (3), and the costs of these may be deducted from the amount awarded in compensation.

*Hospital Expenses—Benefit of Workman (W.C.A.).*—The applicant was injured, and his employers admitted liability, but claimed the right to deduct sums of money paid by them for the support of the man in hospital. His Honour held that these sums were a benefit to the workman to be taken into consideration under Schedule 1, paragraph 3, and allowed the deduction to be made.

[*Suleman v. Owners of the Ben Lomond*, Grimsby C.C., Judge Sir Sherston Baker, 125 L.T.J., 308; 2 B.W.C.C., 499.]

**Medical Fees as Special Damages after the Death of the Patient.**—The law relating to claims made after death for special damages, based on expenses incurred in consequence of personal injuries during the life of the diseased man, is discussed above. (See Death, pp. 913-927.)

In order to discover what fees are recoverable by the survivors, it is all-important to decide whether the claim is to be made under Contract, Negligence (including assault and all torts), or the Workmen's Compensation Act.

If under contract, further to settle whether the death was caused by breach of a contract between the deceased person and the defendant, or, on the other hand, between a third party and the defendant.

### Contract.

(i.) *With the Deceased.*—Where the deceased man was injured owing to breach of a contract made with him, and in consequence he incurred medical expenses before his death, his personal representative in this case can sue for the fees and recover them. (See above, Death—Contract, *Bradshaw v. Lancashire and Yorkshire Railway*, p. 921.)

(ii.) *With a Third Person.*—Where there is a contract between the plaintiff and the defendant, and the latter by breaking it causes death to a third person, and the death is a source of damage to the plaintiff, he can sue the defendant for the damages caused by the breach. If there is a period of illness between the actual breach and the death, necessitating medical attendance for which the plaintiff was liable, he will be able to recover those medical expenses from the defendant as part of the special damages which he has sustained by the breach.

of the contract by the defendant. (*Vide supra*, *Death—Contract*, *Jackson v. Watson*, p. 920, and *Frost v. The Aylesbury Dairy Company*, p. 921.)

### Negligence, etc.

(i.) *Fees payable by the Deceased*.—The personal representative cannot recover fees payable by the deceased person who would, had he lived, have had an action for damages for negligence or other tort. At Common Law no such right exists, and it was decided in *Clark v. The London General Omnibus Co.* (see *Death*, p. 916), that funeral expenses are not part of the damages recoverable under Lord Campbell's Act. Medical expenses would be less likely to be recoverable, for it cannot be held that the "reasonable expectation of pecuniary benefit to the survivors" was affected by the expenses incurred by the deceased man. The same has been held to apply with regard to the estate of the deceased, which has been held not to be affected by the medical expenses rendered necessary in consequence of the injury. (See above, *Death*, *Pulling v. Great Eastern Railway*, p. 919.)

(ii.) *Fees payable by Another*.—Where owing to the relationship of the parties another person is bound to pay medical fees—*e.g.*, parent or husband—he may possibly be able to recover as special damages the expenses, including medical expenses, he was necessarily put to by the injury to his child during the period between injury and death. This is suggested to be the law in *Hall v. Hollander*, 4 B. & C., 660, p. 662.

But this is by no means clear, as funeral expenses have been held not to be recoverable, at all events at Common Law or Lord Campbell's Act, under such circumstances.

"It is therefore necessary to consider whether an action can be maintained at Common Law by a father to recover the expenses of burying his child. I have very considerable doubt on the point, but I think the action cannot be maintained." (*Vide supra*, *Death*, *Baker v. Bolton*, p. 916, and *Jackson v. Watson*, 1909, 2 K.B., p. 193.)

### The Workmen's Compensation Act.

A workman may leave either no dependants, total dependants, or partial dependants. In each case the fees for medical attendance on the deceased man come under different law.

(i.) *No Dependants*.—£10 is the maximum payable by the employer, which sum is divisible between the doctor and undertaker [*W.C.A.*, 1906, Schedule 1 (1), (a), (iii.)].

(ii.) *Total Dependants*.—Total dependants cannot recover any sum for medical expenses paid by the deceased man or themselves. The Act provides a method for calculating the amount payable to them. This sum is based, not on their losses, but on the average weekly earnings of the deceased [Schedule 1 (1), (a), (i.)].

(iii.) *Partial Dependants*.—The amount payable to them is "such sum . . . as may be determined . . . to be reasonable and proportionate to the injury to the said dependants."

*Medical Fees may be included in Amount paid to Partial Dependants (W.C.A.).*—In fixing compensation under the W.C.A., 1897, for the death of a workman in a claim by partial dependants, the arbitrator may competently take into account the outlays which the claimants have incurred in medical and funeral expenses.

[*Bevan v. Crawshay Bros.*, 1902, 1 K.B., 142; 4 W.C.C., 110; *Hughes v. Summerlee Iron Co., Ltd.* (Scottish), 1903, 5 F., 784.]

(c) **Amount of Fees—Medical Attendance.**—As has been said, this is purely a question of contract, and in the absence of express agreement the usual customary and reasonable fees will be allowed, regard being had to the position of the parties, the nature of the work, etc.

*Witness Fees*—(i.) *Facts.*—A mere witness of facts in the County Court and High Court receives the usual fees of a professional man—a minimum of a guinea a day, and necessary travelling expenses.

(ii.) *Expert Evidence.*—An expert's fee is allowed to the medical attendant on the injured person for his evidence, and is usually not less than the last.

(iii.) *Qualifying Fee.*—Where, in order to qualify himself to give evidence, it has been necessary for the doctor to make a special examination of the injured person, a special fee is allowed for this examination, called a "qualifying fee." It is an addition to the expert fee above. The fees vary from one guinea upwards. Fees of thirty guineas have not infrequently been allowed on taxation for the evidence of eminent surgeons, etc.

This fee is not allowable to the medical attendant of the plaintiff; it is only given to a doctor who has specially to examine the plaintiff for the purpose of giving evidence in the case.

(d) **Official Fees.**—In addition to these fees there are numerous official fees for statutory certificates, reports, etc., under Infectious Diseases Acts, Workmen's Compensation Acts, etc.; for acting as referee or assessor none of these have any bearing here.

## 5. Official Medical Men under the W.C.A.

There are six sets of circumstances under which the services of an official medical man are specially provided for under the W.C.A.

1. **Certifying Factory Surgeon under Section 8, Industrial Disease.**—A certificate is necessary for the recovery of compensation for an industrial disease; this certificate is given on a special form. The certifying surgeon may be either the certifying factory surgeon or one appointed having the same powers [Section 8 (5)]. If either master or man is dissatisfied with the certificate, there is an appeal to the medical referee [Section 8 (1), (f); see Referee, below].

"Where the certifying surgeon appointed under the Factory and Workshop Act, 1901, for the district in which a workman is employed, certifies that the workman is suffering from a disease mentioned in the third schedule of this Act, and is thereby disabled from earning full wages at the work at which he was employed . . . and the disease is due to the nature of any employment in which the workman was employed at any time within twelve months previous to

the disablement . . . he . . . shall be entitled to compensation.—Section 8 (1).

*Certificate obtained after Proceedings commenced—No Bar to Proceedings* (W.C.A., Scottish).—The applicant, a workman, on March 1, 1908, first felt symptoms of lead-poisoning, and he was dismissed in April, 1908. He brought arbitration proceedings under the Act, and the case was called in court on July 31. No certificate of disablement had been obtained, and was not, in fact, obtained till September 29. The case was heard on October 21, and though the court below held the absence of the certificate was a bar to the commencement of the proceedings, the Court of Session reversed this and held the absence was no bar.

[Taylor v. Burnham and Co., 1909, 46 S.L.R., 482; 2 B.W.C.C., 247.]

*No Certifying Factory Surgeon for living Seamen at sea.*

[Curtis v. Black and Co., 2 B.W.C.C., 239. *Vide infra*, Poisons—Lead, p. 1048.]

2. **Assessor.**—“A Judge of the County Courts may, if he thinks fit, summon a medical referee to sit with him as assessor.”—W.C.A., Schedule 2 (5).

“Any party to an arbitration may, eight clear days at least before the day fixed for proceeding with the arbitration, file with the Registrar an application according to the form in the appendix, requesting the Judge to summon a medical referee to sit with him as assessor.”—Workmen’s Compensation Rules, Rule 52 (1).

The Judge can accede, refuse, or summon an assessor on his own initiative.—Rule 52 (2, 3, 4).

The medical assessor when summoned to give an impartial opinion should not be sworn (*Hugo v. Larkin*, 3 B.W.C.C., 228).

There is no appeal against the refusal to summon a medical assessor any more than there is against the refusal to refer a case to the medical referee. (See below, *Thrawnmere Bay Development v. Brennan*.)

Even when the assessor is called, his opinion can be ignored, and no appeal would lie on this point (*Langley v. Reeve*, 1910, 3 B.W.C.C., 175).

The value of the medical assessor is seen in three important points, upon none of which can the unaided opinion of a judge ignorant of medicine be equal to that of the judge assisted by a medical assessor, yet many of the County Court Judges habitually refuse to call assessors. Some have stated in open court that they can decide any case without any such assistance:

(i.) *To control the Medical Evidence.*—The presence of an assessor will allow of the correct valuation and checking of ignorant opinions, careless answers, or definite deliberate perjury.

Each of these kinds of evidence has unfortunately occurred, and has produced grave injustice by not being detected and rejected.

(ii.) *To control and interpret exaggeration of the Applicant.*

(iii.) *To interpret the Value of the Evidence of Sensations of the Applicant.*—The applicants frequently give evidence of sensations felt by them both at the time of the accident and after—something “tearing,” etc., at the time of a rupture, is a good example. This evidence always

appears to have great weight with the Judge; but of all the evidence it is the least reliable, as it is easily suggested or taught unintentionally, or even intentionally, by persons interested.

Frequently the so-called sensations are not such as medical men would admit could be caused by the alleged accident (see above, *Female Genital Organs, Sands v. Coppen*, pp. 946-947).

**3. Referee in Industrial Disease: Appeal from the Certificate of the Certifying Factory Surgeon mentioned above.**—“If an employer or a workman is aggrieved by the action of a certifying or other surgeon in giving or refusing to give a certificate of disablement, or in suspending or refusing to suspend a workman . . . the matter shall . . . be referred to the medical referee, whose decision shall be final.”—W.C.A., Section 8 (f).

“Where an employer or workman is aggrieved by the giving or refusal, he may within seven days of the receipt of the notice in the case of the employer, or within seven days of the refusal by the workman, apply to the Registrar of the Court . . . for the matter to be referred to the medical referee.”

The application must be in writing, and accompanied by any available reports of any medical practitioner by whom the workman has been examined.

The medical referee, who must not be the surgeon against whose orders the appeal is made, shall appoint a time and place for the examination of the man, send notice to both parties, who may be present and make statements they think fit, and examine the man at that time; then send a report to the Registrar. (For reports and fees, see below.) [Regulations made June 21, 1907.]

The question submitted to the referee is simply: Is the appeal to be allowed or not? Various other points which are of great medical importance will occur to the referee, but the official forms at present provided only allow for the answer to the question “Yes” or “No.” Failure to give the answer will lead to return of the certificate, or even an appeal to the Court of Appeal.

[*Jones v. Ebbw Vale Steel, Iron, and Coal Co., Ltd.*, 3 B.W.C.C., 181, in which case the Court expressed its opinion to the effect that the official form of the certificate should be altered.]

**4. To decide whether Incapacity, in Workman who wishes to reside Abroad, is of a Permanent Nature** (W.C.A., Schedule 1 [18])—*Workman in Scotland went to Ireland—Not Abroad.*—A workman in receipt of compensation in Scotland went to reside in Ireland. His employer, who was paying him compensation, wished to cease payments under this section.

Held: “Ireland is not *abroad*.”

[*Baird v. Kane* (Scottish), 1905, 7 F., 461; 42 S.L.R., 347.]

**5. Reference to Medical Referees by Arbitrator, Judge, or Committee.**—The importance of the opinion of the medical referee is mentioned above, under Assessor, p. 1015. The Act states: “Any committee, arbitrator, or Judge, may, subject to regulations made by the Secretary of State and the Treasury, submit to a medical referee for report any matter which seems material to any question arising in the arbitration.”—Schedule 2 (15).

It is possibly under this section that the Judges of some County Courts have adopted an admirable practice, which is of the greatest possible advantage in difficult medical cases.

Either before or after hearing the non-medical evidence the Judge sends the case to the medical referee, who hears the medical evidence, examines the man, and then reports on the result of his examination. Counsel appear on either side, and the medical referee, in the cases at which the editor has been present, takes great care to elucidate fully the exact meaning of the medical evidence, and, where this evidence is manifestly unscientific, he asks for an explanation. Cases cannot be so referred without the consent of both sides. At all events this is always asked, and not commonly refused, as refusal to have medical evidence given before the only man who can really understand it is not a strong indication of the validity of the claim.

*Medical Referees, Refusal to Refer to (W.C.A.).*—A workman injured his eye, and there was a conflict of evidence as to whether or not the man had recovered. The employers requested the arbitrator, Judge, to refer the matter to the medical referee, but he refused.

Held: "It was in the discretion of the learned Judge to refer the question to the medical referee, and the Court of Appeal saw no reason to interfere with his decision."

[*Thrawnmere Bay Development v. Brennan, C.A., 1909, Post Magazine, p. 79.*]

*Medical Referee's Report is Expert Evidence.*—The report of the medical referee on a remit under Rule 2 of W.C.A. Rules No. 47 is not to be taken by the arbitrator as final and conclusive, but falls to be considered by him along with other evidence before him. (For notes on this case, see Wounds.)

[*Dowds v. Bennie, 1902, 5 F., 268.*]

*Report of Medical Referee—Private.*—The report of a medical referee is private, and only for the Judge.

[*Bowden v. Barron Brothers, 1901, Times, July 9; 3 W.C.C., 215.*]

*Medical Referee—Respondent's Doctor present at the Examination by him.*—A woman was injured in the eye by a flying shuttle. The evidence was conflicting, and referred to the medical referee, who decided that the case was one of natural cataract. (See Eye.) Appeal on the ground that one of the medical men for the respondent was present at the examination by the medical referee.

Held: "No reason to interfere with the decision of the Judge. There was no evidence of any improper reception of evidence, and he had come to a conclusion on a question of fact which was within his province."

[*Southward v. Oxhey's Cotton Mills, Ltd., 1907, C.A., Post Magazine, vol. lxxviii., p. 621.*]

**6. Joint Reference to Medical Referee by Consent on Order of Court.**—After examination of the workman by medical practitioner, and submission to the other party of the report of such medical practitioner, if no agreement is arrived at as to the workman's condition or fitness for employment, the Registrar of a County Court, on application being made to the Court by both parties, may on payment by the

applicants of such fee, not exceeding £1, as may be prescribed, refer the matter to a medical referee.

The medical referee to whom the matter is so referred shall, in accordance with regulations made by the Secretary of State, give a certificate as to the condition of the workman and his fitness for employment, specifying, where necessary, the kind of employment for which he is fit, and that certificate shall be conclusive evidence as to the matters so certified (Schedule I [15]).

The earlier necessary formalities hardly concern the medical referee, as they are all dealt with before the case is put before him.

It is noticeable that the Registrar, if convinced the man can travel (Rule 54), may order him to attend at the referee's appointed place.

## MUSCLES.

The remarks made above on p. 944, in the cases of injuries to fasciæ, apply equally to muscles.

### Duration of Incapacity.

*Strained Muscles of the Back* (W.C.A., County Court).—On April 27, 1905, the accident happened, and on August 29, 1905, the arbitration proceedings were being conducted, so it would appear that the disability was considered by the workman still to exist at this stage. (Duration, at least four months.)

[*Davis v. The Aerated Bread Company*, Judge Lumley Smith, City of London Court, 1905, 119 L.T.J., 412; 8 W.C.C., 56.]

*Rupture of Fibres* (W.C.A., County Court).—The applicant whilst lifting a beam of about 100 pounds weight (this being part of his ordinary duty, which he had done successfully on many occasions) "suddenly tore several fibres of the muscles of his back. The muscles were not ruptured (*sic*), but the fibres were torn." Accident on September 9, 1899. Arbitration on May 25, 1901. (Duration of incapacity, eighteen months—continuing.)

[*Lee Boardman v. Scott and Whitworth*, Judge Parry, Manchester C.C., 1901, 111 L.T.J., 90; 3 W.C.C., 33. See p. 1019 for C.A. judgment.]

*Back* (W.C.A., County Court).—Fall of a hammer-head from a height of 50 feet, inflicting severe injuries upon the back and causing total incapacity to work. Accident on July 11; arbitration, October 11. (Duration three months—? continuing.)

[*Jones v. Walker* (County Court), Judge Whitehorne, Birmingham C.C., 1899, 105 L.T.J., 579; 1 W.C.C., 142.]

*Strained Muscles of the Back* (W.C.A., Scottish).—In lifting a de-railed hutch into its proper place the workman severely strained his back.

LORD ADAM: "These injuries were not such as would occur in the ordinary course of work."

LORD M'LAREN: "If a workman, in the reasonable performance of his duties, sustains a physiological injury as the result of the work



he is engaged in, I consider that this is accidental injury in the sense of the statute."

[*Stewart v. Wilson and the Clyde Coal Company*, 1903, 5 F., 120.]

*Injury to the Muscles on the Left Side and over the Lower Ribs* (W.C.A., Scottish).—Here the workman was under a misapprehension as to the nature of the injury, in believing it to be less serious than it actually was. The Court held this misapprehension to be a "mistake or other reasonable cause" within the W.C.A., 1897. On November 20 Brown "fell and racked the muscles of his left side and over his lower ribs." He continued to work in spite of his doctor's advice; as he thought his injury would not keep him from work, he did not give notice of the accident to his employers. Eventually he had to give up work on February 6, and he was disabled till May 7. (Duration of incapacity affected by continuing work for some time—three months' work, then three months' incapacity.)

[*Brown v. Lochgelly Coal Company*, 1907, S.C., 198; 44 S.L.R., 180.]

*Ruptured Muscles of Back* (W.C.A.).—The workman while lifting a heavy beam of about 100 pounds weight lacerated the muscles of his back.

COLLINS, M.R.: "He said he was in the act of lifting the beam on to his shoulder, when he found it was unevenly balanced, and that he gave it an extra lift-up to get it on to his shoulder, and felt his back crack. The workman was obliged to meet a sudden emergency by a sudden motion, which resulted in a strain and consequent injury. In this case all the elements are to be found which were said to be necessary to constitute an 'accident' in the cases which have been cited. In my opinion this case is a good illustration of an accident." (Duration of incapacity five months, and continuing.)

Held: "An accident within the W.C.A., 1897."

[*Boardman v. Scott and Whitworth*, 1902, 1 K.B., 43; 3 W.C.C., 33, and 4 W.C.C., 1.]

*Strained Back—Return for Five Years to Heavier Work than before the Accident—Claim "Unable to get Work"* (W.C.A.).—A collier, who had injured his back, received compensation for the injury from September, 1903, to February, 1904, when he returned to work, eventually doing "timber drawing," which was harder work than he did before the accident. For five years he worked at this, and was then dismissed for not doing his work properly. He claimed that he was prevented from getting fresh employment by the after-effects of his accident. The case was referred to the medical referee, who reported as follows:

"The applicant is now suffering from the effects of the accident of September, 1903. These do not render him unfit for work as a timber drawer or as a rider or haulier, but the last two employments expose him to more risk than the first. He is fit for work such as timber drawing, road cleaning, or any work not involving much heavy lifting. The effects of the accident are such as to render him more liable to prolonged trouble from strains in the back. This is the chief objection to his working as a haulier or rider. The present

state of his back handicaps him to some small extent at either of these employments."

The County Court Judge said that he came to the conclusion on the evidence and the report of the referee that the applicant was able and fit to perform the work of a timber drawer, rider, or haulier, or any ordinary work of a labourer; but as the referee was of opinion that his accident rendered him more liable to prolonged trouble in the event of strains of the back, he ordered compensation of one penny a week so as to preserve his full rights in the event of any such strains reoccurring and occasioning such prolonged trouble under circumstances that otherwise would entitle him to compensation. He was not satisfied that the workman was unable to get work by reason of the accident.

From this decision the workman appealed.

COZENS-HARDY, M.R. : "This is simply a question of fact. There was evidence which justified the County Court Judge in his findings. The Court cannot interfere." (Five months' incapacity.)

[Wells v. The Cardiff Steam Coal Collieries, on appeal from Judge Bryn Roberts, of Pontypridd C.C., 1909, 3 B.W.C.C., 104.]

*Strained Back—Stiffness due to Disuse, not the Result of Accident* (W.C.A.).—On May 19, 1905, Holt, who was a bench moulder in a firm of ironfounders, was pulling on a rope when it gave way, and he fell backwards, bruising his ribs and kidney, and straining the muscles of his back. He was paid 18s. 4d. per week, being the full compensation, for three and a half years up till December 5, 1908, when he was examined by Dr. Hunt, one of the medical referees of the Court. The report was as follows :

"The said Thomas Holt is apparently in good health, and is at the present time suffering only from stiffness of the muscles of his back due to long disuse, which condition makes him afraid to use them, and his condition is such that he is fit for his ordinary work, especially if it is resumed in a gradual and easy manner so as not to overtax the muscles until they have recovered their proper tone."

He then returned to light work about December 8, but soon stopped, and, after several reappearances, eventually stopped for good on February 3. He said he had pains in his head and back, and could not work. He filed an application to review. The case was heard on June 28, and was sent to both the medical referees of the Court for them to consider the man's physical and mental condition, and the connection between his condition and the accident. Reports of the evidence given at the hearing were also sent to them. They reported as follows :

Dr. Hunt—

"In accordance with the foregoing reference I have examined Thomas Holt at 54, Preston New Road, on July 22, and I beg to report as follows on the questions submitted to me :

"As to *Physical Condition* : I see no reason whatever to alter the opinion I formed and gave as medical referee on December 5, 1908, to the effect that he is able to resume his usual occupation as a moulder.

"As to *Mental Condition* : I think he has recently worried and brooded so much over his accident that he has worked himself up to such a state that he resumes work anticipating failure, and that after

returning to work he has not given himself time to get into a good and proper condition to do the work as easily as he did before the accident."

Dr. Wraith—

"In accordance with the foregoing reference I have examined Thomas Holt (and carefully studied the evidence forwarded to me) at my residence on July 1, 1909, and I beg to report as follows on the questions submitted to me:

"*Physical Condition*: I am of most definite opinion that Thomas Holt has thoroughly recovered from the effects of his accident on May 19, 1905, and that physically he is now quite able to follow his usual work if he chooses to do so.

"*Mental State*: I can only surmise that his mind will not allow him to summon up courage to persevere at his usual work, for which he is now quite fit and capable of continuously following."

On these reports the workman contended that the Court was bound by *Eaves* and the *Blaenclydach Colliery Company, Ltd.* (see p. 1028), while the employers set up that he was simply soft, and only suffering from the ordinary pains of first return to work.

The Judge said: "Taking first the evidence given before me as affects the case from the date of reduction. I think the effects described as the result of the applicant's return to work were exactly what Dr. Hunt expected from his first report, and, indeed what any lay person would expect—namely, that from the long disuse of the muscles a considerable amount of pain and stiffness would inevitably be felt, but I don't think that it can be said those pains arose from the accident itself. . . . To my mind it is perfectly plain from both reports that physically he has quite recovered from the accident. There then remains the question of his mental state. I have given the best consideration I can to the reports on this head, and in construing them in every way possible I cannot get out of either of them any reason for holding that his mental condition is the result of the accident. I think both gentlemen have failed to find anything really the matter with him. In my opinion, the effect of my refusal to interfere with the order made by the Judge will be a greater incentive to get himself fit for work than a sea-voyage or brain specialist as suggested by Mr. Carter."

The workman was dissatisfied, and appealed, with the result that the following judgment was delivered by the Master of the Rolls: "I agree with the very full and adequate judgment of the County Court Judge, who has found all the facts." (Three and a half years incapacity.)

[*Holt v. Yates and Thom*, on appeal from *Thomas Mansfield*, Deputy County Court Judge at Blackburn, 1909, 3 B.W.C.C., 75.]

### Damages.

*Injury to Muscles of Forearm—Negligence (Damages).*—An electric masseur had his left arm injured at Richmond Station by the slamming of a heavy gate. In consequence he was unable to work for fifteen weeks, and claimed £175 damages. He was awarded £50.

[*Rogers v. L. and S.W. Railway Company, Grantham, J.*, and special jury, *Times*, April 14, 1908.]

*Muscles, etc., of Thigh—Negligence—Future Prospects in Life (Damages).*—The plaintiff at the time of the accident was a young man of twenty-eight, who had been trained for the position of a superintending marine engineer. He had trained himself for that, because he had the prospect, through his relatives, of obtaining such a post. At the time of the accident he had not obtained that position. He was then only in the employment of his father's firm temporarily, at a salary of £3 a week, and living at home. After the accident he made an attempt to obtain employment in connection with some steamers abroad; his application was refused on the ground of his physical condition. The salary attached to that appointment would have been over £500 a year, rising annually. There was ample evidence that he was well qualified to fill that position. In consequence of the accident, which was admittedly due to the negligence of the defendants, "the muscles of the plaintiff's left thigh were seriously injured, and he was under medical treatment for some months. After he was able to walk about again his left knee was very liable to give way, and on several occasions he fell in consequence of this."

It was claimed that it was very common for a man holding the position of superintending marine engineer to receive a salary of from £750 to £1,000 a year, and sometimes as much as £1,500.

The plaintiff's medical and other expenses caused by the accident, together with his loss of salary, amounted to £450.

At the time of the trial he was temporarily earning £2 10s. a week. The jury found for the plaintiff with £3,000 damages.

The defendants gave notice of motion that the judgment be set aside and a new trial had, on the ground that the Judge had misdirected the jury by misstating and not fully explaining to them the effect of the medical evidence, and by omitting to give them accurate direction as to the principle on which to assess compensation in respect of future loss of income, and on the ground that the damages were excessive.

VAUGHAN WILLIAMS, L.J.: "We have endeavoured to give this case every consideration, because it is impossible to ignore the fact that juries are prone to give a plaintiff suing for damages in respect of injuries sustained in a railway accident a larger compensation than justice would permit. Here, undoubtedly, £3,000 does strike one as being somewhat large, and I do not hesitate to say that it is a larger amount than I should myself have given. But it is plain upon the authorities that the mere fact that the verdict is for a larger sum than the judges of the Court of Appeal would have given is not a sufficient reason for granting a new trial. . . ."

". . . Now the rule laid down by Lord Esher, M.R., in *Praed v. Graham* is thus expressed: 'I think that the rule of conduct is as nearly as possible the same as where the Court is asked to set aside the verdict on the ground that it is against the weight of evidence. If the Court, having fully considered the whole of the circumstances of the case, come to this conclusion only, "We think that the damages are larger than we ourselves should have given, but not so large as that twelve sensible men could not reasonably have given them," then they ought not to interfere with the verdict.'

"If one looks merely at the alleged overestimate of the damages in the present case, I am not prepared to say that the damages are so large as that twelve sensible men could not have reasonably have given them. But in my judgment, if we look at the decision in *Phillips v. London and South-Western Railway Company*, whether at the judgment of Cockburn, L.C.J., or at that of James, L.J., in the Court of Appeal, it seems to me that it may sometimes be right to order a new trial, although it cannot be said that the damages are so large that twelve sensible men could not reasonably have given them—that is, in a case in which, although the Court cannot come to the conclusion that the damages are perversely large, yet the amount enables the Court to say that the jury must have disregarded a direction as to the measure of damages which they ought to have regarded. . . .

". . . It is, no doubt, very difficult in the present case to estimate the damages, but I think that, taking the evidence as a whole, it is not unreasonable to say that the jury were entitled to take into consideration as a material and substantial matter the possibility that the plaintiff would never be able to accept the position of a superintending marine engineer. It is obvious that he was intended for that: at the time of the accident that was the intention of his life. . . .

". . . I cannot say that they disregarded the rule laid down in *Rowley v. London and North-Western Railway Company* that the jury may not properly assess as damages a sum of money equal to the present price and value of an annuity equal to that income which would probably have been earned by the plaintiff but for the accident."

[*Johnson v. Great Western Railway*, 1904, 2 K.B., 250 (C.A.), appeal by defendant from judgment of Grantham, J., and jury.]

### **Disease existing before the Accident, and aggravating its Effects.**

*Rupture of Fibres; Fatty Degeneration* (W.C.A., County Court).—On September 18, while lifting an oak bench, "I suddenly felt a pain in my side. I had nothing the matter with me before the accident. After the accident there was a large swelling in my side, and I felt great pain." The medical evidence for the applicant was that "the exertion of lifting the bench strained or otherwise injured the applicant in the muscles of the back, and probably otherwise. His recovery was extremely doubtful." The respondents were of opinion that he had "a tendency to fatty degeneration."

The duration of the incapacity was alleged to be extensive. The accident happened on September 18. The arbitration was held on June 17 of the following year, and "recovery was extremely doubtful." (Duration of incapacity, nine months, and continuing.)

Held by the County Court Judge not to be an accident, but an appeal was entered against his award. After the judgment in *Boardman v. Scott and Whitworth* (see above), it was clear that Perry would also be held by the Court of Appeal to have sustained

an accident, so the case was settled on that basis, and the appeal withdrawn (*vide* 4 W.C.C., p. 3, note).

[*Perry v. Baker*, Judge Stonor, Marylebone C.C., 1901, 111 L.T.J., June 29; 3 W.C.C., 29.]

[NOTE.—The “or otherwise,” quoted above, has of course no meaning, medical or legal.]

## NERVES.

Cases of Nervousness, Hysteria, Fright, Neurasthenia, and Shock will all be found in the section on Neurasthenia.

**Injury to the Brachial Plexus** (W.C.A., County Court).—The important features in this case were the two defences. The first was that he should have undergone active treatment, and did not, in consequence of which the muscles of his arm and shoulder became stiff and rigid, and that his present condition was due to discontinuance of treatment. The second defence was that the hospital treatment was not effective. Neither defence was held to be of use to the employer, and as regards the second the County Court Judge said: “I find that the treatment at the hospital was not defective; and even assuming it to have been defective, I hold that it would have been no defence to this applicant, inasmuch as the applicant had done all he could in going to the hospital and submitting to the treatment administered there, independently of his having gone there at the desire and with the privity and consent of the respondents.”

[*Beadle v. Milton and others*, 1903, 114 L.T.J., 550; 5 W.C.C., 55.]

**Work Palsy—No Accident** (W.C.A.).—Walker was employed by Hockney Brothers as a draper’s porter, and had ridden a carrier tricycle in this work for about six years. He had had pains in his legs for some long time since he rode the tricycle, and had been off work for this reason for three or four days about four years previously to the date of the alleged accident.

In January, 1908, he became so weak in his right leg that he could hardly walk, and went to hospital for twenty-seven weeks. The medical evidence was that the limb was wasted and partly paralyzed. The workman’s doctors attributed the injury to the riding of the carrier tricycle, perpetually overstraining the nerve of the leg, and thus producing a condition which became progressively worse. The employers’ doctor thought the leg was injured by a fall the man had in the street a week or so before he left off work.

During the course of the hearing in the Court of Appeal, the following remarks were made by the Lords Justices, and judgment was delivered by the Master of the Rolls:

MOULTON, L.J.: “It was a breakdown from overwork. Waste overrunning repair is not an accident. If a man breaks down in the course of his labour, that is not an accident.”

FARWELL, L.J.: “You might just as well say that the wearing out by old age is an accident.”

The MASTER OF THE ROLLS, in giving judgment, said that this

man had complained four or five years ago of pain, and it was stated that he had been suffering more or less until there came a final breakdown. He was satisfied that the illness from which the man was suffering was not the result of an accident caused during the performance of his duty.

[Walker *v.* Hockney Brothers, 1909, 2 B.W.C.C., 20.]

## NEURASTHENIA (TRAUMATIC) AND HYSTERIA, MENTAL PAIN, FRIGHT AND SHOCK.

Where the tortious act or breach of contract of one person causes shock to the nerves of another, without any after-effects, no damages can be recovered.

But where such shock has definite after-effects, then, if these effects are the natural and probable consequences of the defendant's act, damages can be recovered.

It was at one time considered that physical impact or force was necessary, and the leading case frequently quoted on that subject is *The Victoria Railway v. Coultas*, but the judgment in the Privy Council expressly avoided giving an opinion on that point. The decision turned really on the remoteness of damages, but in this respect it would perhaps not be followed after *Dulieu v. White*. (See below for both cases.)

### Mental Pain.

KENNEDY, J.: [There is an] "Undoubted rule that merely mental pain unaccompanied by any injury to the person cannot sustain an action."

[*Dulieu v. White*, 1901, 2 K.B., 669 at 673.]

### Fright.

Fear or fright is not a ground for damages or compensation, unless the fright is sufficient to produce in the sufferer those definite changes in the nervous or physical systems known as traumatic neurasthenia or hysteria, numerous cases illustrating which are quoted below. It does not matter whether the fear arises immediately after the event or develop subsequently. But if a man take action through being frightened, or in an attempt to avoid danger, and be injured thereby, he may claim damages for injury so caused from the defendant, provided his act was reasonable and the damages be not too remote. (See below for Fright and its Effects on Third Parties and Animals.)

KENNEDY, J.: "No doubt damage is an essential element in a right of action for negligence. I cannot successfully sue him who has failed in his duty of using reasonable skill and care towards me, unless I can prove some material and measurable damage. If his negligence has caused me neither injury to property nor physical mischief, but only an unpleasant emotion of more or less transient duration, an essential constituent of a right of action for negligence

is lacking. 'Fear,' as Sir Frederick Pollock has stated (4), 'taken alone falls short of being actual damage, not because it is a remote or unlikely consequence, but because it can be proved and measured only by physical effects.'"

[*Dulieu v. White*, 1901, 2 K.B., 669 at 673.]

When a claim is made under the Workmen's Compensation Act, and the workman refuses to return to work through fear of the risk he runs, it is submitted that the question for the arbitrator will be either whether the workman is behaving "reasonably" or whether the work is "suitable," within the meaning of Schedule 1 (3) of the Act.

*Fear of Old Work—Engine-Cleaner* (W.C.A.).—An engine-cleaner lost one arm by injury, and refused to return to his old work at a subsequent date. The Court upheld his refusal. (See *Amputations*, p. 869.)

[*Fraser v. Great North of Scotland Railway*, 1901, 5 F., 908.]

*Fear of Old Work; Loss of One Eye—Coal-Miner's Old Work not "Suitable"* (W.C.A.).—A coal-miner having lost one eye by accident refused to return to his old work as he feared the risk to his remaining eye, and claimed that getting coal at the coal face was not suitable employment for a miner who had recently lost one eye when so employed. The Judge found that the work was not suitable on two grounds:

1. That there was some appreciable risk of injury to the remaining eye and to the man generally in working at the coal face.

2. That the consequences of injury to the remaining eye were far more serious.

The Court of Appeal upheld his first finding, but found the second irrelevant.

[*Eyre v. Houghton Main Colliery Company*, 1910, 3 B.W.C.C., 250.]

*Fear of Work—Injury by Machinery* (W.C.A.).—The applicant lost the top of one finger and a piece of another while working at a stamping machine. She recovered, but said she was afraid to go back to work at any machine for fear that her fingers were again drawn in. The very thought of it made her "feel bad." The Judge said that he must hold that the compensation in the present case must cease, as the whole medical evidence showed the girl to be fit for her work in all respects, except in regard to timidity produced by the accident, and so he reduced the award to a penny a week.

[*Pimms and Sons, Ltd., v. Pearson*, City of London Court, Judge Rentoul, 126 L.T.J., February 6, 1909; 2 B.W.C.C., 489.]

*Fright; Plaintiff's Attempt to save Himself causes Damage—Negligence.*—By the negligence of a coach-proprietor defective reins were provided. On their breaking the horses bolted. The plaintiff, fearing adverse consequences, reasonably thought the best thing to do was to jump off. He did so, and broke his leg. The coach was not, in fact, overturned. The plaintiff recovered damages.



LORD ELLENBOROUGH: "If I place a man in such a situation that he must adopt a perilous alternative, I am responsible for the consequences."

[*Jones v. Boyce*, Lord Ellenborough, C.J. and jury, 1 Stark 493, N.P.]

### Neurasthenia (Traumatic), Hysteria, and Insurance.

*Neurasthenia; Fright; Shock—"Accident"; No Physical Impact (Insurance).*—The terms of the policy between the plaintiff and defendants, who were the railway company, his employers, included an agreement to pay the insured a "weekly allowance . . . in case of his being incapacitated from employment by reason of accident sustained in discharge of his duty in the company's service."

The plaintiff, a signalman, while on duty in his box, saw a train approaching on the line, and noticed that, from the condition of one of the carriages, an accident was imminent unless the train were stopped. He took steps to do this by leaning out of the signal-box and waving a red flag to attract the attention of the engine-driver. The train was stopped, and no accident occurred to it. The plaintiff did not come in any way into contact with the train, but the excitement and the alarm caused by the anticipation of the accident which appeared to be imminent, and the necessity for taking immediate action to prevent it, caused a shock to his nervous system which affected him to such an extent that he became incapacitated from employment, and continued so for more than fifty-two weeks from the date of the occurrence. The defendants paid to the plaintiff a weekly allowance for some time, but they disputed their liability under the policy, and the plaintiff brought this action to recover the balance of £52, the total allowance for fifty-two weeks. The case was tried before Cave, J., and a jury, who found, in answer to a question left by the learned Judge, that the plaintiff was incapacitated from employment by reason of an accident sustained in discharge of his duty in the company's service, and found a verdict in his favour, on which judgment was entered. . . .

The defendants appealed, *inter alia*, on various grounds, that there was no evidence to go to the jury of any accident within the meaning of the policy, and that witnessing an accident was not an accident to the person who does so.

LORD ESHER, M.R.: ". . . The fright which he underwent seems to me to be the accident which happened in this case, and that accident happening in the course of his employment affected his nerves and incapacitated him. . . ."

KAY, L.J.: ". . . But it is said the present case is not within the policy, because all that the plaintiff suffered from was a shock to the nerves, occasioned by the excitement and the responsibility which was thrown upon him. I confess I am unable to follow this argument. It seems to me as clearly an accident as if he had been knocked down by a passing train, and to be clearly within the terms of this policy. . . ."

A. L. SMITH, L.J.: ". . . In my opinion he has met with an accident within the meaning of the policy. It may be that this sort of accident was not thought of when the policy was framed, for

it is of rare occurrence, but that does not prevent its coming within the terms of the policy."

[*Pugh v. London Brighton and South Coast Railway, C.A.*, on appeal from *Cave, J.* (with jury), *Lord Esher, M.R.*, *Kay* and *A. L. Smith, L.J.*, 1896, 2 Q.B., 248.]

*Neurasthenia; Traumatic Hysteria?—Physical Impact; Negligence.*—By the negligence of the defendants a train was backed violently down a steep gradient and stopped with a sudden jerk. Plaintiff was so frightened thereby, and received such a shock to her nervous system, that she could not do her ordinary work, and was threatened with paralysis.

The Judge charged the jury that, if her fright was a reasonable consequence of defendants' negligent act, and the injury to her health was reasonable consequence of the fright, damages for the injury would not be remote.

Held: "A correct charge."

[*Bell v. The Great Northern Railway Company of Ireland*, 26 L.R.I., 428, C.A.]

*Traumatic Hysteria—Physical Impact (W.C.A.)*.—In May, 1905, *Eaves*, a collier, was injured by the falling of a large stone, weighing about half a hundredweight, upon his right foot.

The respondents paid compensation till September, 1908, when, on review, the County Court Judge held: "The man ought to have gone back to work before, and that he was not entitled to further compensation." On appeal, on the ground of misdirection, the matter was remitted to the County Court Judge for reconsideration.

In January, 1909, the man was proved to have recovered his muscular power, but was anæsthetic (*i.e.*, devoid of sensation) in the skin of left leg up to the knee. He said that his knee collapsed when he stood upon it, and that he fell to the ground, and that this was caused by traumatic neurasthenia.

The County Court Judge's finding was approved by the Master of the Rolls.

*COZENS-HARDY, M.R.*: "The effects of an accident are at least twofold: there may be merely muscular effects—they almost always must include muscular effects—and there may also be, and very frequently are, effects which you may call mental, or nervous, or hysterical, whichever is the proper word to use in respect of them. The effects of this second class as a rule arise directly from the accident from which the man suffered, just as much as the muscular effects do; and it seems to me entirely a fallacy to say that a man's right to compensation ceases when the muscular mischief is ended, though the nervous or hysterical effects still remain. The result of this judgment, however, is that the man is still suffering from the accident, and he has not wholly recovered from the nervous effects of the accident, which are just as real and just as important as the muscular effects, and make him unable to work."

*FLETCHER MOULTON, L.J.*: "It is quite clear that serious muscular and nervous consequences followed from the accident that happened to this workman. The muscular consequences have disappeared, but that the nervous consequences still remain is common ground,

because there is the very remarkable fact of almost total anæsthesia of the leg. . . . In my opinion, as long as these serious consequences remain, the man is entitled to compensation just as much as if his muscular power had not come back."

FARWELL, L.J.: "The man is suffering from traumatic neurasthenia, and he has not recovered from it. Therefore he has not recovered his earning capacity, and is still entitled to compensation."

Held: "The anæsthesia renders him incapable of working."

[*Eaves v. Blaenclydach Colliery Company, Ltd.*, 1909, 2 K.B., 73; 2 B.W.C.C., 329.]

*Traumatic Hysteria—Physical Impact (W.C.A.)*.—The applicant, a young carpenter, was injured by a fall and burns at a fire in a factory. He complained of headache, sleeplessness, instability, inability to work, fatigue, and two years after the injury was also found to have loss of sensation to the lining of his nose, loss of the sense of taste for the left half of his tongue, loss of sense of smell in the left nostril, and of hearing in the left ear. After the case had been before the Court on several separate occasions, an application was finally made to redeem the weekly payments by a lump sum. On this occasion Dr. Head, for the respondent, said that the whole of these symptoms were due to traumatic hysteria, and not traumatic neurasthenia. Dr. Seymour Taylor, also for the employer, said that in his opinion Mead was suffering from traumatic neurasthenia.

Dr. Hyslop said the cause of the condition was an organic injury to the brain, possibly a fractured base of the skull. The arbitrator, with the assistance of the medical assessor, found that, though Mead was suffering from traumatic neurasthenia, there should be complete recovery in one year, and made a final award on that basis.

[*Mead v. Lockhart, Barnet C.C.*, Judge Howland Roberts. Local papers, February 24, 1908, and after; 2 B.W.C.C., 148.]

NOTE.—This case is also discussed on p. 1009, Medical Man.

*Neurasthenia—Physical Impact (W.C.A.)*.—The applicant in carrying some heavy buckets of molten gutta-percha stumbled, and "twisted" himself. He vomited blood, and went to the Seamen's Hospital. He afterwards went to the London Hospital for four months, where he was under the care of Dr. Thompson, who said that at the date of the hearing, owing to his nervous condition, the man was not fit for any but light work. The doctor for the master said that the neurasthenic symptoms were only due to medical examination, and not to the injury, and that the man was otherwise fit for work.

Compensation was continued.

[*Smart v. India-Rubber and Telegraph Company, Bow C.C.*, Judge Smyly. Local papers, April 11, 1908.]

*Neurasthenia—Physical Impact; Negligence*.—Mrs. Twyner was injured by the negligence of a tramcar of the West Ham Corporation. She was knocked down, and her teeth were loosened, and four came out afterwards. She was incapacitated from doing household work for some time. She had been in bed for six weeks,

and in her room for two months. Dr. Oldfield said she was suffering from neurasthenia. Damages £50.

[*Twynner v. Derry and the West Ham Corporation*, Bow C.C., Judge Smyly. Local papers, February 22, 1908.]

*Neurasthenia—Physical Impact ; Negligence.*—On August 2, 1907, the plaintiff, a gardener, was on a tramcar, when he was thrown from the lower platform to the road, owing to the tramcar shooting forward with a jerk. His head was badly cut; he was unconscious for two days. His right hand had been weak ever since, and he claimed that at the time of hearing, January, 1908, he was still in a condition of neurasthenia. Damages £100.

[*Fisher v. Leyton District Council*, Bow C.C., Judge Smyly and jury. Local papers, January 18, 1908.]

*Neurasthenia—Physical Impact ; Negligence.*—The defendants' tram was stopped with a sudden jerk, throwing the plaintiff upon her back, striking her head upon the floor, rendering her unconscious for twenty minutes, and nervous ever since. Damages £20.

[*Johnson v. The Great Northern and Piccadilly Railway Company*, Clerkenwell C.C., Judge Edge and jury.]

*Neurasthenia ; Fear of Danger—No Physical Impact ; Negligence.*—It was averred for the pursuer (plaintiff) that a carriage door on defenders' (defendants') railway broke open, and swung back violently against the carriage by the motion of a passing train, smashing the glass and splintering the woodwork. The pursuer was greatly alarmed, thinking there was a collision. Her nervous system received a shock, resulting in lasting injury.

Held: "The averment disclosed a cause of action."

[*Cooper v. Caledonian Railway*, 1902, 4 F., 880.]

*Neurasthenia ; Explosion causes Shock—No Physical Impact ; Negligence.*—An explosion occurred in an electric main. Plaintiff was passing at the time, and received a severe nervous shock which injured her. She was not actually struck by anything.

Held: "The case must go to the jury."

[*Solomons v. Stepney Borough Council*, 69 J.P., 360; 3 L.G.R., 912.]

*Neurasthenia—No Physical Impact ; Negligence.*—The plaintiff was standing behind the bar of her public-house when the defendant's servant negligently drove a horse and cart into the bar. She was very frightened and received a nervous shock, which caused her a serious illness.

For further notes on this case, see *Genital Organs—Female*, p. 948.

Held: "She could recover damages therefor."

[*Dulieu v. White*, 1901, 2 K.B., 669.]

*Neurasthenia ; Shock ; Practical Joking—No Physical Impact (Damages).*—The facts are sufficiently set out in the following judgment:

WRIGHT, J.: "In this case the defendant, in the execution of what he seems to have regarded as a practical joke, represented to the

plaintiff that he was charged by her husband with a message to her to the effect that her husband was smashed up in an accident, and was lying at The Elms at Leytonstone with both legs broken, and that she was to go at once in a cab with two pillows to fetch him home. All this was false. The effect of the statement on the plaintiff was a violent shock to her nervous system, producing vomiting and other more serious and permanent physical consequences, at one time threatening her reason, and entailing weeks of suffering and incapacity to her, as well as expense to her husband for medical attendance. These consequences were not in any way the result of previous ill-health or weakness of constitution; nor was there any evidence of predisposition to nervous shock or any other idiosyncrasy.

"In addition to these matters of substance there is a small claim for 1s. 10½d. for the costs of railway fares of persons sent by the plaintiff to Leytonstone in obedience to the pretended message. As to this 1s. 10½d. expended in railway fares on the faith of the defendant's statement, I think the case is clearly within the decision in *Pasley v. Freeman*, 1789, 3 T.R., 51. The statement was a misrepresentation intended to be acted on to the damage of the plaintiff. The real question is as to the £100, the greatest part of which is given as compensation for the female plaintiff's illness and suffering. It was argued for her that she is entitled to recover this as being damage caused by fraud, and therefore within the doctrine established by *Pasley v. Freeman*, 1789, 3 T.R., 51, and *Langridge v. Levy*, 1837, 3 M. and W., 519. I am not sure that this would not be an extension of that doctrine, the real ground of which appears to be that a person who makes a false statement intended to be acted on must make good the damage naturally resulting from its being acted on. Here there is no *injuria* of that kind. I think, however, that the verdict may be supported upon another ground. The defendant has, as I assume for the moment, wilfully done an act calculated to cause physical harm to the plaintiff—that is to say, to infringe her legal right to personal safety, and has, in fact, thereby caused physical harm to her.

"That proposition without more appears to me to state a good cause of action, there being no justification alleged for the act. This wilful *injuria* is in law malicious, although no malicious purpose to cause the harm which was caused nor any motive of spite is imputed to the defendant.

"It remains to consider whether the assumptions involved in the proposition are made out. One question is whether the defendant's act was so plainly calculated to produce some effect of the kind which was produced that an intention to produce it ought to be imputed to the defendant, regard being had to the fact that the effect was produced on a person proved to be in an ordinary state of health and mind. I think that it was. It is difficult to imagine that such a statement, made suddenly and with apparent seriousness, could fail to produce grave effects under the circumstances upon any but an exceptionally indifferent person, and therefore an intention to produce such an effect must be imputed; and it is no answer in law to say that it was too remote. . . ."

[*Wilkinson v. Downton*, *Wright, J.*, and jury, 1897, 2 Q.B., 57.]

"*False Neurasthenia*" (W.C.A.).—The applicant, Eliza Steele, a charwoman, was wounded by a needle, which penetrated her palm on November 20, 1907. It became deeply embedded between the metacarpal bones and remained there.

Dr. Waters, who first saw her, advised against operation, as the deeper parts of the hand might be injured by it, and the needle was doing no harm.

She became nervous, however, and an unsuccessful operation was performed, which in the opinion of her doctor caused contraction of the structures deep in the palm, preventing her working. Her chief complaint was pain running up the hand into the left shoulder.

It was admitted that, had she not undergone the operation, she would soon have recovered from the injury.

It was contended by the employers that her condition was due to nervousness, and that her inability to work was not caused by any alteration in the structures in the palm of the hand, but by unreasonable belief that she could not use the hand.

The following is taken from the Judge's award:

"Dr. Godfrey Walker was of opinion that the deeper structures of the hand must have been affected by the operation, and that there is a scar within the deeper structures of the hand. His evidence was that, if the scar had only been a superficial one, the hand would recover. He admitted that if in May, 1909, she had closed her hand tightly, and force was required to make her open it, this would dispose of his theory about the deeper structures being involved.

"Dr. Collie examined the applicant in May, 1909. He said he asked her to close her fist. She did so easily, and the fingers went tight into the palm. He then asked her to keep the fist closed while he forcibly opened it. She resisted him, and kept her hand tightly closed, and he further described the tests which he applied. He agreed with Dr. Walker that if the deeper structure of the hand had been involved, the contraction would be permanent. Mr. Porter, the surgeon, gave evidence to the same effect as Dr. Collie. On this evidence the substantial question is whether I can rely upon Dr. Collie's evidence as accurately describing what occurred when he examined the applicant. It is conceded by the medical witnesses for the applicant that if Dr. Collie's statement in fact is correct, then there was no permanent injury at the time.

"It is impossible for me to believe that Dr. Collie was not giving accurate evidence upon a question of fact. If the matter only to be considered was a difference of medical experts upon the question of expert knowledge or opinion, I might have been called upon to determine which of the medical experts were in my judgment correct in their statement. Dr. Collie's reputation is too well assured to make it impossible for me not to believe him upon a mere question of fact. I must, therefore, arrive at a conclusion of fact that the contraction was not caused by any scar in the deeper structures of the hand.

"I am satisfied that the applicant is not malingering, and that her incapacity to use the hand arises from her nervous mental condition, which has induced in her a firm belief that she cannot use her hand owing to the continued presence of the needle. I think the words 'false neurasthenia' are apt to describe her state.

“That she suffered from pain when using her fingers I have no doubt. The operation was performed as long ago as October, 1908. Mr. Porter, surgeon, was of the opinion that the applicant could have done a little work in January, 1909, and that in May, 1909, she would have been all right. The medical witnesses for the applicant did not give any evidence to suggest that this was not the case. Assuming that Dr. Collie’s evidence was accurate, the applicant’s case throughout was that the incapacity is permanent. The point to be considered and decided is whether the condition of the hand in May, 1909, and since, is due to want of reasonable care and conduct on the part of the applicant in not exercising the fingers of her hand, or was the incapacity the consequence of the accident? The evidence has established that, if the applicant had acted reasonably, her hand would have been available for ordinary work in May, 1909, and therefore the absence of reasonable conduct and care has, in this case, broken the chain of causation, and the principles laid down and illustrated by *Warncken v. R. Moreland and Son. Ltd.*, 1909, 1 K.B., 184; 2 B.W.C.C., 359, *Tutton v. Owners of the Steamship Majestic*, 1909, 2 K.B., 54; 2 B.W.C.C., 346, and *Marshall v. Orient Steam Navigation Company*, 1910, 1 K.B., 79; 3 B.W.C.C., 15, apply to this case. Now, I think that in judging what is reasonable conduct I must apply an ordinary test—namely, in this particular case what would an ordinarily prudent and reasonably minded person have done? If the applicant omitted to do what a reasonably minded and prudent person would have done, then I think she was unreasonable in her conduct in not having exercised or worked her hand in a reasonable manner, which would have prevented the condition of things which now exists.”

[*Steel v. Bilham*, Southend C.C., Judge Tindal Atkinson. Heard November 13, 1909; judgment February 10, 1910.]

NOTE.—Since the award in this case the unfortunate applicant has gone into hospital, where she has been operated upon for cancer of the breast on the same side as that where she felt the pain in the arm and shoulder.

### Fright of Third Parties or Animals.

If the tortious act of one person frighten another person or an animal, and damage be thereby caused to the plaintiff, then, apart from any question of damage to the frightened person or animal, the damages so caused to the plaintiff have often been held to be the natural consequences of the tort, and so recoverable.

*Animal frightened; Horse Shies at Obstruction left by Roadside—Nuisance; Natural Consequences; Death of Driver; Negligence.*—James Harris drove his horse, which was a kicker, though he did not know it, along the metalled part of the highway. On the grass at the side a large van was drawn up with ploughing-gear attached. The horse shied, started kicking, bolted, and threw out Mr. Harris; kicked him severely. He eventually died of the injury. His executors brought a claim under Lord Campbell’s Act for damages, and recovered £250 damages.

The statement of claim alleged “that the defendant so wrongfully

and negligently obstructed the highway by placing and leaving thereon a large house van, with ploughing-gear attached; that the deceased was hindered and prevented in his user of the highway, and his mare was frightened and rendered unmanageable, and his cart damaged, and he received serious injuries in the knee, of which he died."

Several other witnesses proved that their horses had also shied at the van, etc.

The defendant said the horse shied after it had passed the van, and was vicious; but the jury found the deceased man did not know of it. The defendant also contended that it was not the necessary or natural result of being frightened that the mare should kick violently and destroy the vehicle it was drawing. They further contended that no action would lie for an obstruction of the highway, where the person alleged to be obstructed was using a different part of the highway—viz., the metalled part of the road, and that there was no instance . . . of an action for damage caused by an obstruction to a highway, where the obstruction consisted merely of some occupation of the ground likely to cause terror to horses passing along the highway.

DENMAN, J.: "I think that it follows, from cases which have been decided, that if there be an act done upon any part of the highway which is not a part of the reasonable user of it, and which has the effect of endangering its use to others, and damage results from such an act in the course of a lawful user of the highway, an action will lie for such damages. It has been held that the occupation of one side of a public street for several hours at a time, so as to prevent any carriage from passing on that side of the street, although room was left for two carriages to pass on the opposite side, is an indictable nuisance (*Rex v. Russell*, 6 East, 427); from which case, and from the case of *Reg. v. Cross*, 3 Camp., 224, it appears that the real question in such cases is whether the highway has been obstructed for an unreasonable time and in an unreasonable manner, or, in other words, in such a way as to amount to something beyond a fair and reasonable use of the way. The jury in the present case have found that the van in question was unreasonably left where it was at the time of the accident, by which I understand that it was not a fair and reasonable use of that part of the highway with reference to the rights of others.

"They have also found that it was appreciably dangerous, by which I understand that it was in their opinion likely to cause horses to shy or take fright in passing along the metalled part of the road. . . . I cannot agree with the view submitted by the defendant's counsel that there must be an injury caused by an actual physical obstruction before an action will lie. Suppose a man were to occupy the grassy side of a highway with three or four cannon, and to keep firing them from morning to night, so as to terrify the horses passing along the metalled part of the road, I cannot doubt that he would be liable for the consequences, and that he would have wrongfully hindered and prevented in the user of the highway anyone whose horse might have been frightened by such conduct. . . .

"I now come to the part of the case which has appeared to me false the most difficult. It was, I think, clearly made out at the



trial that the mare which the deceased was driving was a vicious mare, in the sense that she was a kicker. It must, however, be taken that the jury negatived any knowledge in the deceased of this habit, such as would have rendered it negligent in him to drive the mare. Contributory negligence on any other ground was negatived. . . .

“ . . . Then, was the kicking which caused the death a natural and necessary consequence of the act complained of? I think, upon the whole, that it was. The van was there, and it, in fact, frightened the deceased mare so that she shied and swerved to run away, and having got one wheel on the footpath, kicked violently, and within 150 yards fell and injured the deceased so that he died. The whole transaction is within a few seconds, and originates in the fright of the mare caused by the van. I think it cannot be laid down as having been the duty of the deceased to abstain from driving the mare. On the other hand, it cannot be laid down as the right of the defendant to assume that no nervous or runaway or kicking horse would come along the highway. It is only in the case of horses liable to be frightened that any danger exists, and where a horse has once been frightened by a dangerous apparition unlawfully placed on the highway, running away and kicking can hardly be considered to be unusual or unnatural consequences of the fright. The wrongdoer has no right to lay down the measure of his own wrong, or to limit the free use of the highway to horses which shall only shy when frightened and do no further mischief.”

[Harris v. Mobbs, Denman, J., and jury, 1877-1878, L.R., 3 Ex. Div., 268.]

*Fright; Horse Shies at Roller by Roadside—Reasonable Use of Highway; Nuisance; Negligence.*—The defendant farmed land on either side of the highway. His servants removed a roller from one of his fields across the highway to the gate of the opposite field, and, taking away the horses, left the roller unattended on the green sward at the roadside with its shafts turned up, but projecting a few inches over the metalled part of the road. The plaintiff's wife drove past the spot, and her pony shied at the roller, overturned the carriage, and caused her death.

The Judge at the trial left it to the jury to say whether the placing the roller where it was and leaving it there was a reasonable user of an undoubted highway.

The jury found that it was not, and gave a verdict for the plaintiff, damages £100.

On further argument :

GROVE, J.: “I am of opinion that the plaintiff in this case is entitled to judgment. *Rex v. Cross*, 3 Camp., 224, *Rex v. Jones*, 3 Camp., 230, and *Harris v. Mobbs*, 3 Ex. D., 268, are distinct authorities to show that all the Queen's subjects are entitled to the free and unobstructed use of the highway, and that an action will lie for an injury resulting from ‘an occupation of a part of the highway amounting to an obstruction and prevention of its free user by the public to an extent which is unreasonable.’ Here was unquestionably a legal nuisance, and an undoubted injury resulting from that legal nuisance. How can we say that that is not actionable?”

[*Wilkins v. Day, Grove and Mathew*, JJ., 1883, 12 Q.B.D., 110.]

**Damages too Remote, or not the Natural Consequences.**

*Neurasthenia caused by Shock—No Impact; Damages too Remote; Negligence (P.C.).*—Mrs. Coultas was being driven across a level-crossing by her husband when, owing to the negligent way the railway was managed, she and her husband (in the words of the Statement of Claim) “were placed in imminent peril of being killed by a train,” and in consequence Mrs. Coultas received a severe shock and suffered personal injuries, and still suffered from delicate health and impaired memory and eyesight.

The defence was that it was not stated that either the plaintiffs or their property were struck or touched by the train of the defendants; and, further, that the alleged damage arising from shock or fright, without impact, was too remote to sustain the action.

The gates had been opened by the gatekeeper, and a train arrived and passed so close that it nearly touched the carriage of the plaintiffs. The fright of Mrs. Coultas was caused by seeing the train approaching, and thinking they were going to be killed. The jury found that the defendants’ servant negligently opened the gate and invited the plaintiffs to drive over the level-crossing when it was dangerous to do so, and that the plaintiffs could not have avoided what had occurred by the exercise of ordinary care and caution on their part. Damages to the male plaintiff £342 2s., and to the female £400.

SIR RICHARD COUCH, giving the judgment of the Privy Council, said:

“Damages arising from mere sudden terror accompanied by actual physical injury, but occasioning a nervous or mental shock, cannot under such circumstances, their Lordships think, be considered a consequence which, in the ordinary course of things, would flow from the negligence of the gatekeeper. . . .

“. . . Their Lordships are of opinion that the first question, whether damages are too remote, should have been answered in the affirmative, and on that ground, without saying that ‘impact’ is necessary, that the judgment should have been for the defendants.”

[Victorian Railway Commissioners *v.* Coultas on appeal to the Privy Council, Lord Fitzgerald, Lord Hobhouse, Sir Barnes Peacock, and Sir Richard Couch, from an order of the Supreme Court of Victoria, B.C., 1887, 13 App. Cas. 222.]

NOTE.—This case was considered in *Dulieu v. White and Sons* by the Court of Appeal and not followed. *Vide supra*, pp. 948 and 1030.

*Slander; Shock—Not the Natural Consequences of Wrongful Act.*—Thomas Allsop said that Hannah Allsop had had improper relationship with him after her marriage with William Allsop.

“By reason of the committing of the grievances, the said Hannah became, and was, ill and unwell for a long time and unable to attend to her necessary affairs and business, and the plaintiff, William Allsop, was put to and incurred much expense in and about the endeavouring to cure her of the illness which she laboured under as aforesaid by reason of the committing of the said grievances, and the said William Allsop lost the society and association of his said wife in his domestic affairs, which he otherwise would have had.”

POLLOCK, C.B.: “We are all of opinion that the defendant is

entitled to judgment. There is no precedent for any such special damage as that laid in this declaration being made a ground of action so as to render words actionable which otherwise would not be so. We ought to be careful not to introduce a new element of damage, recollecting to what a large class of actions it would apply, and what a dangerous use might be made of it. In actions for making false charges before magistrates, for giving false characters, and for torts of all kinds, illness might be said to have arisen from the wrong sustained by the plaintiff. The case of *Ford v. Monroe* (a) is the only authority that has any tendency to throw light on the argument; but we ought not to act upon the authority of that case, opposed as it is to the universal practice of the law in this country. The Courts here have always taken care that parties shall not be responsible for fanciful or remote damages, or in fact any that do not fairly and naturally result from the wrongful act itself. . . .

“. . . This particular damage depends on the temperament of the party affected, and it may be laid down that illness arising from the excitement which the slanderous language may produce is not that sort of damage which forms a ground of action.”

BRAMWELL, B.: “I am of the same opinion. This question seems to me one of some difficulty, because a wrong is done to the female plaintiff, who becomes ill, and therefore there is damage alleged to be flowing from the wrong; and I think it did, in fact, so flow. But I am struck by what has been said as to the novelty of this declaration, that no such special damage ever was heard of as a ground of action. If it were so, I am at a loss to see why mental suffering should not be so likewise. It is often adverted to in aggravation of damages, as well as pain of body. But if so, all slanderous words would be actionable. Therefore, unless there is a distinction between the suffering of mind and the suffering of body, this special damage does not afford any ground of action. There is certainly no precedent for such an action, probably because the law holds that bodily illness is not the natural nor the ordinary consequence of the speaking of slanderous words. Therefore, on the ground that the damage here alleged is not the natural consequence of the words spoken by the defendant, I think that this action will not lie.”

[*Allsop v. Allsop*, 5, H. and N., 534.]

*Neurasthenia; Shock; Effects of Sight of Death—Negligence; Damages too Remote.*—A man was killed by the negligent acts of the defendants. The shock of seeing the death caused the plaintiff to become ill, suffering from “*Neurasthenia*,” and he sued for damages.

Held: “This harm was too remote a consequence of the negligence.”

[*Smith v. Johnson and Co.*, before 1897. *Wright and Bruce, JJ.*, noted in *Wilkinson v. Downton*, 1897, Q.B., 61, and referred to by *Kennedy, J.*, in *Dulieu v. White*, 1901, 2 K.B., 669 at 675.]

*Neurasthenia: Shock caused by the Death of Another—Damages too Remote.*—A father and mother suffered from shock caused by the death of their daughter. The death was the result of the negligence of the defendants' servants, who ran over and killed her.

Damages were not recoverable by the parents for the neurasthenic

condition produced by the shock, there being no duty towards them broken by the defendants.

[*Clark v. London General Omnibus Company*, 1906, 2 K.B., 648.]

## NOSE.

Diseases of the nose, when caused by industrial conditions, may give rise to a right of compensation under the Workmen's Compensation Act.

Certain poisons, especially chrome, are particularly liable to cause ulceration of the nose. This condition is fully described in the medical article on the Nose. Among the poisons mentioned in the third schedule to the Workmen's Compensation Act, 1906, are various poisons affecting the nose; the ulceration caused by dust is mentioned in the most recent addition: "Ulceration of the Nose produced by Dust" (Order of Secretary of State, December 2, 1908).

*Bone broken; Damages—Negligence.*—A lady suffered from a broken nose, the result of injury through the negligence of the defendants. She was awarded £40 damages.

[*Watkins and Wife v. The Great Western Railway Company*. See *Bones: Fractures, Head*, p. 881.]

## ÆSOPHAGUS—PANCREAS—PERITONEUM.

The Editor has not up to the present been able to find any legal cases upon injury to these parts.

## PERJURY.

Though perjury is common, especially under the Workmen's Compensation Act, yet hitherto there have been very few prosecutions for it, and, though not strictly germane to this Case Guide, a few illustrative cases are quoted here.

**An Arbitration under the Workmen's Compensation Act is a Judicial Proceeding** (W.C.A. and C.C.A.).—A workman in the course of arbitration proceedings had committed perjury, for which he was indicted, tried, found guilty, and sentenced. He appealed on the ground that no prosecution could be instituted for perjury committed in an arbitration under the W.C.A.

Held: "Proceedings in arbitration proceedings before a County Court Judge under the Workmen's Compensation Act, 1906, are judicial proceedings, and therefore a witness who in such proceedings gives false evidence on a material question may be indicted for perjury."

[*Rex v. Crossley*, 1909, 1 K.B., 411; 2 B.W.C.C., 45.]

*Perjury* (W.C.A.).—Accused at first pleaded not guilty, but soon withdrew his plea and pleaded guilty. He had been in custody two

months, and the Recorder therefore passed a sentence of two months' imprisonment upon him, which under the circumstances entitled him to instant discharge.

[*Brown v. Saunders, Policy Holder*, xxvi. 769.]

*Illegitimate Child — Paternity; Dependancy* (W.C.A.). — Rebecca Alexander claimed compensation on behalf of her daughter Amelia, whom she alleged to be the illegitimate child of a coloured cook, named Henry Nicholas, who was killed by an accident when employed by the respondents.

The woman said she had lived with Nicholas for two and a half years, and that he was the father of her child. She denied that her name was formerly Vicars, or that she was married, or that she had ever lived with a man named Alexander.

She said she had lost the certificate of the child's birth, and that she did not put down any name as that of the father when registering it. When confronted with a copy of the birth certificate, she admitted that it had on it the father's name, Edward Ward Alexander, and that he was her husband, and that her name was formerly Vicars.

JUDGE SMYLY said: "I am afraid the witness has been telling us what she knew to be untrue. There must have been a regular conspiracy in this case, because there must have been a lot of people who knew that this woman was married. This case is supported by barefaced perjury."

[*Alexander v. Crowe, Rudolf and Co., Bow C.C., Judge Smyly; Policy Holder*, xxvi. 841.]

## POISONS.

The only poisons included in the medical sections of this book are those scheduled under the third schedule of the Workmen's Compensation Act, 1906; in this part a few other poison cases are included. Under the Workmen's Compensation Act, 1897, disablement caused by poisons, when gradual in its onset, was held not to be "an accident." (See below, Lead.)

Cases of ptomaine or food poisoning are collected in the section on Ptomaine-Poisoning.

## Insurance.

*Poison accidentally taken—Insurance.*—Exact words: "Death . . . caused by accidental, external and visible means within the intention of this policy and the provisions and conditions thereof. . . . Provided further that the insured shall not be entitled to make any claim under this policy . . . and that this insurance shall not extend to death . . . by poison or intentional self-injury, etc."

Subsequently to effecting the policy the insured accidentally drank some poison in mistake for medicine which he was in the habit of taking. The result was fatal, and his widow sued for the £1,000 which was the amount covered by the policy.

Held: "The accident came within the proviso, and that the representatives of the insured were not entitled to recover."

[*Cole v. The Accident Insurance Company, Ltd.*, Huddleston, B., and special jury; on appeal to Divisional Court, Mathew and Grantham, JJ., 1889, 61 L.T., 227.]

*Coal Gas—Insurance.*—*Vide infra*, Gas, p. 1042.

### Arsenic.

*Arsenic, Beer—Warranty of Fitness for Consumption* (Sale of Goods Act, 1893, Section 14).—The plaintiff bought beer off the defendant at a public-house which was tied to Messrs. Holden and Co., Ltd., brewers. The jury found: "We are satisfied that the plaintiff's illness was caused to a large extent by arsenical poisoning due to the defendants' beer, and was contributed to exceedingly by excessive drinking."

Held: "That the beer had been bought by description within the meaning of Section 14 (2) of the Sale of Goods Act, and that, as an examination by the buyer would not have revealed the defect, the defendant was liable under an implied warranty that the beer was of merchantable quality."

"Though there was an opportunity for inspection, the defect could not be discovered by inspection. The plaintiff was in the habit of going to the house because he could get Holden's beer, and, upon the facts found by the jury, he in substance bought it by that description."

[*Wren v. Holt*, 1903, 1 K.B., 610; 19 T.L.R., 292.]

*Arsenic, Beer* (Sale of Goods Act).—In January, 1900, the defendants agreed to supply to the plaintiffs sulphuric acid described as B.O.V. (brown oil of vitriol). For four or more years previous to this day they had supplied them with oil of vitriol, which had always been pure—*i.e.*, free from arsenic. In March, 1900, the defendants supplied the acid unpurified—*i.e.*, containing arsenic. The sulphuric acid was used by the plaintiffs for making glucose and invert sugar, which was sold by them to brewers for making beer. The defendants had never been informed by the plaintiffs of the purpose for which the acid was wanted, or to which it was being applied.

The glucose containing the arsenic was sold by the plaintiffs to brewers, who used it in making beer, which a large number of persons drank, and in consequence were made seriously ill, and some died. The plaintiffs claimed that there was an implied term of the contract that the goods should correspond with the description—*i.e.*, should be free from arsenic—within the meaning of the Sale of Goods Act, Section 13.

BRUCE, J., found as a fact that, having regard to the dealings between the plaintiffs and the defendants, there was a contract for sale of goods by description, but "that the plaintiffs had not especially or by implication made known to the defendants the particular purpose for which the goods were required, so as to bring into operation

Section 14, Subsection 1, of the Act; that the plaintiffs' chemist might, by the exercise of ordinary care, have discovered the presence of the arsenic in the acid before it was used; and that the plaintiffs' consulting chemists might have discovered the presence of arsenic in the glucose and invert manufactured by the plaintiffs."

Damages were claimed by the plaintiffs for—(1) the price paid for the acid; (2) the value of the materials used for making the glucose; (3) compensation for loss of goodwill; (4) damages which the plaintiffs were liable to pay to the brewers who had been supplied by the plaintiffs with glucose containing arsenic.

Held: "The plaintiffs can recover the price of the acid and the value of the goods spoilt, but not damages for the loss of the goodwill or the damages paid to the brewers."

BRUCE, J.: "The claim of the plaintiffs for the loss of the goodwill of their business is not, I think, recoverable. It does not seem to me to be a loss directly and naturally resulting in the ordinary course of events from the breach of warranty. The poisonous glucose and invert were not supplied by the defendants to the plaintiffs, but were manufactured by the plaintiffs. . . . The damage to their credit arose, not directly from any act of the defendants, but arose from the act of the plaintiffs in manufacturing glucose and invert by means of poisonous acid, and selling the glucose and invert so made as fit to be used in the brewing of beer. . . ."

"Further, I think that the plaintiffs are not entitled to recover against the defendants the sums which the brewers, to whom the plaintiffs sold the glucose and invert made from the poisonous acid, are entitled to recover against them. I think the rule is correctly laid down in Smith's "Leading Cases" in the note to *Vicars v. Wilcocks*, that no liability is incurred in the ordinary case of a separate and distinct collateral contract with a third person uncommunicated to the original contractor or wrong-doer, although the non-performance of this contract may in one sense have resulted from the original wrongful act or breach of contract. In my opinion there are no special circumstances to entitle the plaintiffs to claim special damages under Section 54 of the Sale of Goods Act.

[*Bostock and Co., Ltd., v. Nicholson and Sons, Ltd.*, King's Bench, Bruce, J., 1904, 1 K.B., 725.]

*Arsenic in Paint* (W.C.A.).—The applicant, a painter, in May, 1908, entered the employment of the respondent to paint carriages. He had to paint and varnish and touch up a four-wheel cab with a little light green paint. He had also to re-japan the top parts. He worked for about a month. After he had been there for a fortnight, using white lead, he said that he found his fingers were being blistered. He had pains in the head, and vomiting. On August 26 he obtained a certificate from Dr. John Brunton, the deputy certifying surgeon, that he was suffering from arsenical poisoning. The master denied that any arsenic had been used. They used what was called "coach green." Dr. John Brunton admitted that he had never heard of a coach or house painter developing symptoms of arsenical poisoning under many months, that the man also exhibited symptoms of probable lead-poisoning, there

was tremor of the fingers, and numbness that might be due to arsenic or alcohol, and the pains in his stomach might be due to lead or ordinary colic. For the employer, Dr. Howett said there were some signs of peripheral neuritis, inflammation of the nerves of the arm, which might result from alcohol, lead, or arsenic, and that the man could not have developed lead or arsenic poisoning in five weeks. A small award was made in favour of the applicant, who was well at the time of the hearing.

[*Scott v. Pope*, Clerkenwell C.C., Judge Bray. Local papers, December 17, 1908.]

### Belladonna.

*Wrong Label by Chemist; Negligence* (American).—Winchester, who was a wholesale manufacturer of drugs, sold to Aspinwall, a druggist, some extract of belladonna labelled "Extract of Dandelion." Aspinwall, relying on the label, sold some of it to another druggist, who dispensed it to Mrs. Thomas, the plaintiff in the present action. She took some of it and became very ill. On recovery she sued Winchester, and the jury gave \$800 damages. Winchester appealed on the ground, *inter alia*, that he being the remote vendor no action would lie against him, as there was no privity between him and her.

Held: "A dealer in dangerous drugs who carelessly labels a deadly poison as a harmless medicine, and sends it so labelled into the market, is liable to all persons, who, without fault on their part, are injured by using it as such medicine in consequence of the false label. The liability of the dealer in such cases arises, not out of any contract or direct privity between him and the person injured, but out of the duty which the law imposes upon him to avoid acts in their nature dangerous to the lives of others. He is liable, therefore, though the poisonous drug with such label may have passed through many intermediate sales before it reaches the hands of the person injured. When such negligent act is done by an agent, the principal is liable for the injury thereby."

[*Thomas v. Winchester*, on appeal to the Court of Appeal of the State of New York, Ruggles, C.J., Gardiner, J., and other JJ., 1852, 6 N.Y.R., 412.]

### Carbolic Acid.

*Mistaken for Wine* (W.C.A.).—A man drank carbolic acid in mistake for wine, and died. The accident was held not to have arisen out of the employment, and the employer was not liable.

[*Davies v. Owners, etc.*, 1908, *Policy Holder*, xxvi. 422.]

### Chloride of Lime.

*Dangerously Packed on Board Ship—Negligence*.—The plaintiffs were owners of a ship upon which the defendants shipped casks of dangerous bleaching powder—chloride of lime. The casks were insufficiently strong for their contents, which escaped and did damage, for which the plaintiffs were liable as shippers.

CAMPBELL, C.J., and WIGHTMAN, J. (in a united judgment): "The statement of claim does not charge any fraud or show any deceitful act or concealment which can be considered the foundation of an action purely *ex delicto*. . . . But I think that it states facts which



show that *ex contractu* a duty was cast upon the defendants, that they have violated this duty, and that, the violation of this duty having caused loss to the plaintiffs, a good case of action is disclosed.

“Where the owners of a general ship undertake that they will receive goods and safely carry them and deliver them at the destined port, I am of opinion that the shippers undertake that they will not deliver, to be carried in the voyage, packages of goods of a dangerous nature which those employed on behalf of the shipowner may not on inspection be reasonably expected to know to be of a dangerous nature without expressly giving notice that they are of a dangerous nature. . . .”

[*Brass v. Maitland*, on demurrer, *Campbell, C.J., Wightman, J., Crompton, J.*, 1856, 6 Ell. and B., 470.]

NOTE.—This is a case of dangerous goods carried on board ship. It is not a case where personal injury resulted therefrom, but it is quoted here as it was largely the foundation of the judgment on the case of *Farrant and Barnes* quoted below (*Nitric Acid*).

*Bleaching Powder—Sale—Goods Dangerous to the Knowledge of Seller.*—*Vide supra*, Eye.

[*Clarke v. Army and Navy Stores.*]

### Gases.

*Coal Gas Poison; Death—Insurance* (American).—Actual words: “The policy shall not extend to . . . any bodily injury of which there shall be no external and visible sign upon the body . . . nor to any death or disability which may have been caused . . . by the taking of poison . . . or inhalation of gas.”

The policy was to cover injury or death.

The insured was found dead in an hotel; the gas had been turned on, and had caused his death. There was no external or visible sign of injury upon the body.

Held: “The provision requiring such a sign did not apply in the case of death, but only to injuries entitling the insured to a weekly indemnity, during their continuance; and that death was not caused by ‘the inhaling of gas,’ as these words only applied to voluntary and intelligent action on the part of the insured, and not to an involuntary and unconscious act; and, further, that death was caused by ‘external and visible means’ within the terms of the policy.”

[*Paul v. The Travellers’ Insurance Company*, 1889, 112 *Sukel’s New York Reports*, 472.]

NOTE.—This case reversed *Hill v. Hartford, etc., Company*, 22 *Hun.*, 187, where the death of a doctor, who was insured against death from “external and violent means,” was held not to be within the policy when his death had been due to drinking poison in mistake for water accidentally.

*Carbonic Acid Gas* (W.C.A., Scottish).—A workman, finding a fellow-workman in danger in a ship’s hold, voluntarily and deliberately, knowing and having in view that he was going to encounter a serious and perhaps deadly danger, left his place of work, boarded the ship, offered to descend into the hold, had himself purposely lowered into it by the crane, and so purposely and deliberately put

himself into contact with the poisonous fumes, by the direct action of which he died.

The LORD JUSTICE CLERK said: "In so acting he did not wait to receive instructions from his employer. I cannot doubt that in sudden emergency, where there is danger, a workman does not go out of his employment if he endeavours to prevent it from taking effect. For example, if, in a yard where a man is working, a horse suddenly runs off, and there is danger to others, and met with an injury, he suffered that injury in the course of his employment. It was a right thing to do, in the interests of the safety of those in the yard, and therefore in the interests of his master."

[London and Edinburgh Shipping Company v. Brown, 1905, 42 S.L.R., 357; 7 F., 488.]

*Carbon Monoxide in a Mine* (E.L.A., Scottish).—A coal-miner was working in a mine when he died on April 27, 1906. The mine was ventilated by an air-current which was driven past the seat of an old fire which was still smouldering. For two days before his death the workman and others had noticed a haze and a smell, and some of the men suffered from vomiting and headache. Carbon monoxide has no colour, taste, or smell. The smell spoken of appears to have been caused by a watery vapour or smoke from the smouldering fire, which also produced the carbon monoxide.

[Black v. The Fife Coal Company, Ltd., 46 S.L.R., 191; 2 B.W.C.C., 456.]

*Coal Gas* (W.C.A., County Court).—A man employed at a gas-works was found dead, and a coroner's jury found that death was due to gas-poisoning. Compensation was awarded to the widow.

[Carney v. Stockport, 1908, *Policy Holder*, xxvi, 146.]

*Contamination of Water by Coal Gas—Company having Statutory Power to Supply Gas—Nuisance—Negligence.*—The Tunbridge Wells Gas Company laid their gas-pipes in the same channels as the water main. Gas escaped, and contaminated the water. The owners of houses supplied with the water brought an action to stop the contamination.

The Gas Company were acting under statutory powers, but restricted by the Gas Works Clauses Act, which prevented them from committing a nuisance, and allowed actions to be brought against them if they did so.

FARWELL, J.: "The first point is this: The defendants have a statutory authority to lay down gas-pipes, but they are also bound by Section 29 of the Gasworks Clauses Act, 1847 (10 and 11 Vict., c. 15), and by Section 9 of the Gasworks Clauses Act, 1871 (34 and 35 Vict., c. 41). The latter clause is one of extreme stringency. The words are: 'Nothing in this or the Special Act shall exonerate the undertakers from any indictment, action, or other proceeding for nuisance in the event of any nuisance being caused by them.' Now, to my mind it is impossible to say that the impregnation of the water-supply to a house with coal gas is not a nuisance. The defendants tender evidence to show that first of all the diffusion of gas is unavoidable, and that that diffusion becomes noxious only by reason of its accumulating about the gas main during a considerable period, and then permeating to other places. Further, they

desire to give evidence to show that the main and the service pipes were laid as well as could be. In my opinion neither of these facts, if proved, would afford any answer to the present case.

"Then Mr. Jenkins's next point is that the plaintiffs' water-pipe is defective. Now, as regards that, in my opinion this case comes within the well-known principle established by the House of Lords in *Rylands v. Fletcher* (*supra*). . . .

". . . And upon authority, this, we think, is established to be the law, whether the things so brought be beasts, or water, or filth, or stench; and I would add 'gas.' It is clearly a non-natural user of the land to put gas-pipes in it. When a company chooses for its own profit to bring a gas-pipe upon land, they must keep it there at their own peril. It is no answer to say to the plaintiff, 'True it is that your water-pipe answers all your purposes,' or, if you please, 'Your water-pipe is leaky, and it is very foolish of you not to make it better than it is, and, if it were not for the leak, the gas could not enter. If you make your water-pipe gastight you would not be affected.' He owes no duty to the defendant to make his water-pipe gastight—not at all.

"It appears on the evidence that the defendants have since action brought made certain alterations to their main, the effect of which is that at present there is no nuisance arising from the gas. That being so, no injunction is now asked for. I therefore propose to make a declaration to the effect that the defendants are not entitled to pollute or contaminate by coal gas the water-supply of the two houses of the plaintiffs."

[*Batcheller v. Tunbridge Wells Gas and Coke Company*, 1901, 84 L.T., 765.]

NOTE.—This is not a case of personal injury or disease due to contamination of water, but an example of the sort of action that could arise from such a cause as escaping gas. Had disease been the consequence of the contamination that would have been ground for damages.

*Gas Escape—Explosion—Negligence.*—Gas escaped from the defendant's pipes, and for some days caused a smell in the streets. The company, on receipt of a complaint, sent a man down to the spot to examine the pipes, but while he was fetching tools for repairs three explosions took place. The plaintiff and his wife were injured, though they had no gas laid on to their house, so that no carelessness on their part could have caused the explosion.

The defence was that, with twenty-five miles of pipe, the company could only do their best as reasonable men, and that they could not be expected to inspect all this pipe daily. The plaintiffs relied partly on the fact that the gas had been smelt for some days before the explosion.

POLLOCK, C.B., in summing up to the jury, told them "that it was the duty of all gas companies to use due and reasonable care to prevent mischief from the escape and explosion of gas, and that there was evidence here from which the jury might come to the conclusion that there had not been such due and reasonable care."

Verdict for the plaintiff, £160 damages.

[*Mose and Wife v. St. Leonards Gas Company*, Lewes Assizes, Pollock, C.B., and jury, 1864, 4 F. and F., 324.]

NOTE.—This, too, is an illustrative case of the right of action for damages, though they did not, in fact, include personal injuries in this case.

*Sewer Gas Poisoning.*—See Intestines.

### Lead.

*Paint on a Grass Field which had let for "Eatage"*—Contract.—The defendant, Mr. Sutton, hired the "eatage" of a field belonging to Thomas Temple. The defendant put beasts in it to consume the "eatage," but four died, and were found to have in their stomachs a quantity of old refuge paint. This paint was found to have been scattered with manure as a fertilizer to the "eatage."

Thomas Temple did not know that the paint was on the field at the time he let it, and sued Mr. Sutton for the rent.

LORD ABINGER, C.B. (after comment on *Smith v. Marrable*, *vide supra*, p. 969, for that part of his judgment): "In the letting of [furnished] houses . . . the goods and chattels so supplied are intended for a specific purpose. But in this case the action is brought for the fulfilment of certain contract applicable to land—viz., for the 'eddish' or 'eatage' of a field—that is, the use of the herbage to be eaten by cattle—for a certain time. . . . It is not suggested that the plaintiff had the least knowledge of the cause of this injury when he let the land. Now, it is said that there was, under these circumstances, an implied warranty on the part of the plaintiff, that the 'eatage' was wholesome food for cattle. But I take the rule of the law to be, that if a person contract for the use and occupation of land for a specified time, and at a specified rent, he is bound by that bargain, even though he took it for a particular purpose, and that purpose be not attained. . . ."

" . . . Here the defendant is to pay £40 for a given portion of a year, and nothing is stipulated as to his getting any benefit by the occupation of the land. I think, therefore, that in this case the plaintiff is entitled to recover her whole rent. It is no doubt a case of considerable hardship on the defendant; but we must decide with reference to general principles of law, and not upon the hardship of any particular case. . . ."

PARKE, B.: "With respect to the other and principal question in this case—namely, whether a contract or condition is implied by law, on the demise of land, that it shall be reasonably fit for the purpose for which it is taken. If the question were *res integra*, I should entertain no doubt at all that no such contract or condition is implied in such a case. The word 'demise' certainly does not carry with it any such implied undertaking; the law merely annexes to it a condition that the party demising has a good title to the premises, and that the lessee shall not be evicted during the term. If it included any such contract as is now contended for, then, in every farming lease, at a fixed rent, there would be an implied condition that the premises were fit for the purpose for which the tenant took them, and it is difficult to see where such doctrine would stop."

[*Sutton v. Temple*, 1843, 12 M. and W., 52, on appeal to Court of Exchequer, before Abinger, C.B., Parke, Gurney, and Rolfe, BB.]

*Lead-Poisoning—Not an Accident* (W.C.A.).—The gradual onset of a disease, such as lead-poisoning, was held not to be an accident under the Workmen's Compensation Act, 1897, but lead is now in the third schedule of the 1906 Act.

COLLINS, M.R. : "In my opinion it is clear . . . that an accident must be something of which the date can be fixed. Here the injury was that of lead-poisoning. . . . In any case it must have been caused by long exposure to the influence of lead. It is impossible in this case to fix the date of that from which the injury arose."

[*Steel v. Cammell, Laird and Co.*, 1905, 21 T.L.R., 490; 1905, 2 K.B., 232; 74 L.J., K.B., 610; 7 W.C.C., 9.]

*Lead, Red—Wounds, Blister* (W.C.A.).—The workman blistered one of the fingers of his right hand while chipping plates. Into the wound some red lead entered, and inflammation was set up. This was held not to be an accident, as it was an ordinary consequence of the work; but this judgment is usually considered to be overruled by *Brinton v. Turvey*.

[*Walker v. The Lilleshall Coal Company*, 1900, 16 T.L.R., 108; 2 W.C.C., 7.]

*Paralysis* (W.C.A.).—The applicant had been employed for seventeen years as a painter under Mr. Willett up to September 21, 1907, when he left this master, and two days after entered the employment of Charles Manners for a few days. On October 11 he had a paralytic stroke from which he died, the cause of which was certified to be lead-poisoning. An award by consent was made against his old employer, Willett.

[*Griffiths v. Willet and Manners, Barnet C.C.*, Judge Howland Roberts, February 29, 1908.]

*Estimate of Degree of Liability with Each Employer* (W.C.A., County Court).—A man had worked for twenty-six weeks in the last twelve months as a painter in the service of five separate employers. His Honour said that, from the evidence, it seemed pretty fair to assume that he would absorb into his system equal amounts of lead day by day during these employments, and if they divided the amounts of compensation into twenty-sixths, and multiplied it by the number of weeks he was in each employment, they would get the amount of liability of each employer.

[*Pennington v. Best, Policy Holder*, xxvii. 114.]

*Degree of Liability of Each Employer* (W.C.A.).—A workman had been engaged as painter to two different employers, namely, Messrs. Waring and Fergusson. He had worked for Messrs. Waring for the fourteen weeks previous to his being incapacitated, and for Messrs. Fergusson for the thirty-seven weeks before that. There was no dispute as to the lead-poisoning, but only as to the contribution of Messrs. Fergusson. Mr. H. D. Elliott submitted that, where a disease is a gradual process, it is fair to presume that the same amount of lead is being put into the system day by day. His Honour accepted the contention, and made an award on the basis that Messrs. Waring paid  $\frac{17}{52}$ , and Messrs. Fergusson  $\frac{37}{52}$ .

[*Lees v. Waring and Fergusson, Manchester C.C.*, Judge Parry; *Manchester Guardian*, August 17, 1909.]

*Certifying Surgeon (W.C.A.)*.—The workman had been employed as a file-maker for many years, and was disabled from following his employment. "His symptoms were certified to be more or less those of lead-poisoning." There was no evidence that any lead had been used in the course of the man's employment within twelve months before the date at which he was taken ill. The arbitrator refused to make an award in favour of the workman under these circumstances, and the Court of Appeal upheld his decision.

[*Houghton v. Peter Stubbs, Ltd., C.A., April 1, 1908; Board of Trade Labour Gazette, May, 1908, 155.*]

*Lead-Poisoning in Seaman at Sea (W.C.A., Section 8, i., ii., iii.)*.—The applicant, a boatswain, had been employed by the respondents on and off since 1900, part of his duties being to use red and white lead in painting the ships' holds. In December, 1900, he had an attack of lead-poisoning, which lasted five months. From August, 1907, till April, 1908, he had been employed on the respondents' ships mixing the paints, and during the course of this work he became incapacitated from wrist-drop. His Honour refused the application.

COZENS-HARDY, M.R., said that he thought that the learned County Court Judge was perfectly right. His lordship did not know whether this was an intentional omission from the Act, but it was plain to his mind that, before a workman could claim the benefit of Section 8, there must be a certificate from a surgeon appointed under the Factory and Workshops Act, 1901, for the district in which the workman was employed. There could be no surgeon so appointed in the case of a seaman, and it was impossible to read the section as it stood without holding that it did not apply to a seaman.

[*Curtis v. Black and Co., 25 T.L.R., 621; 2 B.W.C.C., 239.*]

*Certifying Factory Surgeon's Certificate of Lead-Poisoning*.—Proceedings commenced before certificate obtained; no bar to proceedings. *Vide supra*, p. 1015.

*Acute Ulcerative Colitis as a Sequela of Lead-Poisoning (W.C.A.)*.—A painter was held to have died from acute ulcerative colitis and heart failure, caused by lead-poisoning. He became ill at the end of November, and died in December of acute ulcerative colitis.

[*Smith v. Waring and Gillow, Westminster C.C., Deputy Judge Local papers, May, 1908.*]

*Nephritis Alleged, but not Proved, a Sequela of Lead-Poisoning. Vide supra, Kidney, p. 987 (Haylett v. Vigor).*

## Nitric Acid.

*Injury to Carrier who was not Warned of his Risk—Negligence*.—Rayner, a carman, was asked by the defendant to carry a carboy of nitric acid, but refused, as it was against the regulations of his master. He said he would ask the plaintiff to carry it, and he did so. The plaintiff Farrant was the servant of a carrier, Russell by name. He took the carboy, knowing it to contain acid, but not dangerous nitric acid. The acid escaped and seriously injured the plaintiff.

The defence set up was that there was no privity between the plaintiff and the defendant.

The jury awarded £50 damages. The defendant appealed.

ERLE, C.J.: "The defendant, knowing the dangerous character of the article and omitting to give notice of it to the plaintiff, so that he might exercise his discretion as to whether he would take it or not, was guilty of a clear breach of duty."

Held: "The defendant was liable for the injury thus resulting from his breach of duty."

[Farrant v. Barnes, on appeal from Blackburn, J., Croydon Assizes, before Erle, C.J., Willes and Keating, JJ., 1862, 11 C.B.N.S., 553.]

### Opium.

*Overdose—Death—Negligence* (Public Authorities Protection Act).—The plaintiff, a widow, claimed damages for the husband's death, which she alleged was due to the administration of an overdose of opium by a hospital nurse at the Tolworth Isolation Hospital, to which he had been admitted as suffering from typhoid fever. The damages were claimed under the Fatal Accidents Act, Section 3, which provides that actions shall be commenced within twelve months after the death.

This action was commenced six and a half months after the death, and the defendants claimed that they were entitled to the protection of the Public Authorities Protection Act, which declares that an action against any person "for any act done in pursuance, or execution, or intended execution, of any Act of Parliament, or in respect of any alleged neglect or default in the execution of any Act, must be commenced within six months next after the act, neglect, or default, complained of, or, in case of continuing injury or damage, within six months next after the ceasing thereof."

Held: "That the plaintiff's cause of action arose upon the death of the deceased, and that, the action not having been brought within six months after his death, the defendants were entitled to the protection of the Public Authorities Protection Act, 1893, and the action was not maintainable."

[Markey and another v. The Tolworth Joint Isolation Hospital District Board, Divisional Court, Darling and Bigham, JJ., 1900, 2 Q.B., 454.]

### Yew.

*"Escape" of Yew Branches—Poison—A Horse killed.*—The branches of a yew-tree planted by the defendant grew over their boundary into the plaintiff's field. The plaintiff's horse ate of the yew-tree and died; the plaintiff claimed the value of the horse.

KELLY, C.B.: "It does not appear from the case what evidence was given in the county court to prove, either that the defendants knew that yew-trees were poisonous to cattle, or that the fact was common knowledge amongst persons who have to do with cattle. As to the defendants' knowledge it would be immaterial, as whether they knew it or not they must be held responsible for the natural consequences of their own act. It is, however, distinctly found by the judge 'that cattle frequently browse on the leaves and branches of

yew-trees when within reach, and not unfrequently are poisoned thereby, is a fact generally known'; and by this finding, which certainly is in accordance with experience, we are bound."

Held: "That the defendants were liable on the principle of the maxim, *Sic utere tuo ut alienum non lēdas*."

[*Crowhurst v. Amersham Burial Board*, on appeal, Exchequer Division, Kelly, C.B., and Pollock, B., 1878, 4 Ex. D., 5.]

*"Escape" of Yew-Tree Branches—Poison—A Horse killed.*—The defendant owned a field, and the fence and ditch at the side of it. The ditch was beyond the fence, and the plaintiff's field lay alongside the ditch. The defendant was under no duty to fence against the plaintiff's cattle. On the defendant's side stood a yew-tree, branches of which spread over the fence and part of the ditch, but no branch reached the plaintiff's land. The plaintiff's horse ate yew-leaves and died. The defendant was held not liable because his yew-tree did not "escape" over the plaintiff's land, and there was no duty on him to prevent the plaintiff's horses from trespassing to eat the branches. It was emphasized in the judgment that, for the doctrine of *Rylands v. Fletcher* to apply, there must be an "escape."

[*Ponting v. Noakes*, 1894, 2 Q.B., 281.]

## PRESERVATIVES IN FOOD.

The editor has not at present been able to discover any cases where the injurious effect of preservatives in food has been made the subject of a civil action. (Preservatives for adulteration, etc., are not included in this Case Guide.)

## PTOMAIN-POISONING.

*Bad Food and Drains—Contract.*—Plaintiff was staying in March, 1907, at an hotel in which the drains were being taken up. He suffered from diarrhœa, etc., which he alleged was due to bad food, foul air, or a combination of both.

In the following December his doctor described him as "a wreck," which he said was the consequence of the illness occurring after his residence in the hotel.

Held: "There was a bad smell from the drains which affected the plaintiff's health, and lowered his vitality so as to make him a more ready victim to absorb the ptomaine-poisoning."

Damages £75.

[*Vansittart v. The British Tea Table Company*, Westminster County Court, 1907, *Times*, December 11.]

*Tinned Salmon—Contract* (Sale of Goods Act).—Tinned salmon caused the death of the plaintiff's wife and the illness of the plaintiff; and he claimed for medical expenses, funeral expenses, and the value of the loss of the services formerly rendered by his wife.

Held: "That he was entitled to recover damages under all these heads."



The answer of the jury to the question left to them by Judge was as follows:

"That the death of the plaintiff's wife was caused by eating the tinned salmon, and that the buyer relied upon the seller's skill and judgment as to its fitness for the purpose of human food, and that the salmon was unfit for food."

"The action was for breach of warranty, nothing else."

[*Jackson v. Watson*, 1909, 2 K.B., 193.]

*Tinned Salmon—Contract* (Scottish).—A lad ate some tinned salmon purchased by his father off M'Hardy, a retail grocer. Two hours after eating it he became ill, and he died seven days later. The cause of death was certified to be ptomaine-poisoning, and his father, Adam Gordon, sued the grocer for £300 damages for the loss of his son.

The claim was that the salmon was unfit for food; that the tin had no label upon it, and that it was dented as if knocked about; that it was the duty of the defendant to examine all tins containing foods which he was selling to the public, in order to satisfy himself that they were air-tight and in order; and that he took no reasonable and proper precautions nor made any proper examination of the said tin.

(There was no averment that the grocer M'Hardy knew, or had reasonable grounds of suspecting, the salmon to be unwholesome. It was not said that the tin was not air-tight.)

LORD JUSTICE CLERK: "I am of opinion that a grocer who gets a quantity of tins of preserved food, and sells them to the public as he gets them, cannot be liable for the condition of the contents of the tins, if he buys from a dealer of repute. It is said the tin which was sold to the pursuer (plaintiff) was dented, but it is not averred that the dent had cut through the metal and allowed the air to get in, or otherwise caused an injury to the contents, which the defendant should have noticed."

Held: "As this is an action for *culpa* (tort), not breach of contract, the retail dealer is not liable for latent defects in a specific article."

[*Gordon v. M'Hardy*, Court of Session, Scotland, on appeal, before Lord Justice Clerk, Lords Trayner and Moncrief, 1903, 6 F., 210.]

*Kipperd Herring—Restaurant—Contract*.—Mr. Hands went for his breakfast to Slater's restaurant, where he ate a kippered herring. He said afterwards that he thought it tasted "musty." Some time afterwards he developed violent vomiting, purging, and collapse, which his doctor attributed to the kipper. Mr. Hands sued Messrs. Slater, who denied that their kipper, which had been purchased with all the care possible from one of the best merchants, was responsible. It was admitted that the kipper might cause poisoning without giving out any unpleasant odour other than that natural to kippers in general. The defence alleged that the cause of the illness was "gastro-enteritis," or summer diarrhœa, for the kipper was eaten in the summer.

The jury exonerated the kipper and Messrs. Slater from all blame.

[*Hands v. Slater* (unreported), King's Bench, 1909.]

## RABIES.

The editor has not been able to discover any reported case where rabies has been made the subject of a civil action.

## RUPTURE.

For notes on this most fertile source of fraudulent claims, see the section on Malingering at the end of the medical article on Rupture.

Rupture cases are here dealt with under four heads :

1. Rupture arising *de novo* from the accident (extremely rare).
2. Rupture rendered worse by an accident.
3. Operation.
4. Capacity for work after rupture.

### 1. RUPTURE ARISING "DE NOVO."

#### Insurance.

*Rupture* (Insurance).—Policy insured "against cuts, stabs, etc., when accidentally occurring from material and external cause, where such accidental injury is the direct and sole cause of death." But the policy excepted certain complaints (of which hernia was one) "arising within the system of the insured, before or at the time or following such accidental injury, whether causing death directly or jointly with such injury."

Held: "That hernia caused solely or directly by external violence followed by a surgical operation for the purpose of relieving the patient is not within the above exception."

WILLIAMS, J.: "I am of opinion that it [the condition] means to exempt the company from liability only where the hernia arises within the system. . . . I think the company are not relieved from responsibility where hernia is caused by external violence."

[*Fitton v. Accidental Death Insurance Company*, 1864, 01 demurrer, before Williams, Wills, and Byles, JJ., 17 C.B.N.S., 122; 1865, 34 L.J., C.P., 28.]

*Rupture* (W.C.A.).—This is the leading case on the meaning of "personal injury by accident." The workman was ruptured during his ordinary work by an act of overexertion in trying to turn a wheel. He did not suffer from any external violence or new strain in the course of his work. It is true that the evidence showed that there were certain unusual incidents in the machinery whose presence might be called accidental, but in most of the judgments these incidents were expressly put aside as being not essential to an accident. The accident was held to be the sudden rupturing of the man's body; and in reference to these other details LORD MACNAGHTEN said: "Fenton was a man of ordinary health and strength. There was no evidence of any slip or wrench or sudden

jerk. It may be taken that the injury occurred while the man was engaged in his ordinary work, and in doing or trying to do the very thing which he meant to accomplish. There is evidence that the wheel was short of one spoke or handle, which may have made it more difficult to grasp than usual, and it was discovered afterwards that there was a leak in the kettle which let moisture into the vessel below, gluing its contents together, and so causing it to stick. I mention these circumstances merely for the purpose of putting them aside . . . in my opinion they did not affect the question. . . . If a man, in lifting a weight or trying to move something not easily moved, were to strain a muscle, rick his back, or rupture himself, the mishap in ordinary parlance would be described as an accident. Anyone would say that the man had met with an accident in lifting a weight, or trying to move something too heavy for him. . . . The expression 'accident' is used in the popular and ordinary sense or the word as denoting an unlooked-for mishap or an untoward event which is not expected or designed. . . ."

LORD LINDLEY: "The word 'accident' is not a technical legal term with a clearly defined meaning. Speaking generally, but with reference to legal liabilities, an accident means any unintended or unexpected occurrence which produces hurt or loss apart from its cause, and if the cause is not known the loss or hurt itself would certainly be called an accident. The word 'accident' is also often used to denote both the cause and the effect, no attempt being made to discriminate between them. The great majority of what are called 'accidents' are occasioned by carelessness, but for legal purposes it is often important to distinguish careless from other unintended and unexpected events. With the decision in *Hensey v. White*, and the decisions in which that case has been followed, including *Roper v. Greenwood*, speaking with all deference, I am unable to agree. There is, however, a recent decision of the Court of Session in Scotland to which I should like to call your lordships' attention, in which I agree entirely. It is the case of *Stewart v. Wilson and Clyde Coal Company*, 1903, 5 F., 120." (See above, *Muscles*.)

LORD SHAND: "The word 'accident' in the statute is to be taken in its popular and ordinary sense; I think it denotes or includes any unexpected personal injury resulting to the workman in the course of his employment from any unlooked-for mishap or occurrence."

[*Fenton v. Thorley and Co.*, 1903, A.C., 443; 19 T.L.R., 684; 5 W.C.C., 1.]

*Rupture* (W.C.A.).—Morgan was mate of a sailing vessel, and was ruptured when at work. After some time he had so far recovered that by wearing a truss he was able to return to his full work as an A.B. The employers then applied to have their liability entirely ended. The County Court Judge accepted their contention, and made an order terminating the weekly payments.

Held by the Court of Appeal: "This cannot be done; the wearing of a truss does not constitute a cure." (For further notes on this case, see *Cure and Return to Work*.)

[*Owners of vessel Tynron v. Morgan*, 1909, 2 K.B., 66; 2 B.W.C.C., 400.]

*Rupture* (W.C.A., Scottish).—Blacksmith while shoeing a horse was kicked, causing serious injuries which resulted in rupture. [Caledonian Railway v. Breslin, 1900, 2 F., 1158.]

*Rupture: Evidence of "Recent" Rupture; Conflict of Medical Evidence* (W.C.A.).—On June 14, 1907, Chapman, a trimmer on the s.s. *Anglian*, which was owned by the respondents, complained to the captain of a lump in his side. The lump was about the size of the top joint of Chapman's thumb, and he said he had never had anything wrong there before in his life. The captain and the steward examined him, considered him to be ruptured, and put him on a truss, which he wore for two watches—a few hours—and never wore again. No further complaint was made that voyage, Chapman doing his full work, and the ship reached England, where he was discharged.

(No claim was made for accident on this occasion, and even if it had been it would not have succeeded, as the 1897 Act did not apply to seamen, and the 1906 Act did not come into force till July, 1907.)

Chapman signed on for the next voyage as fireman, which was far harder work than trimmer, his former work; and the second engineer, Donald, who signed him on, said he would not have taken him on had he known he was ruptured. On arriving at the end of the voyage, in London, he for the first time complained of an accident to Donald, the engineer, but gave no data. Chapman said he complained of pain in his stomach to Donald on July 16, but did not say he had had any accident at that time. Donald said the first intimation of a rupture was when the ship had reached London, on July 23, when Chapman said he was ruptured, but said that it was by a cob of coal falling upon him. The man went to the Seamen's Hospital, and was operated upon on August 21 (about 5½ weeks after the accident), by Mr. Cantlie, F.R.C.S., and Dr. Ziervogel. The latter's evidence was taken on commission, and was in the hands of both parties at the hearing of the arbitration.

The state found on admission and at the operation was a large left scrotal hernia reaching to the bottom of the scrotum. The contents were omentum, which was not adherent but was irreducible. The sac was "very thick walled," and the distance between the external and internal rings, which is normally 2½ inches, was so much reduced that they were almost opposite each other. The hole was large enough to "admit two fingers easily." The hernia was of the congenital variety.

Chapman swore that after the first incident, on June 14, he had had no more trouble. He stated that the lump which then appeared came out when he stood up, and retired when he lay down. He wore the truss for two watches, then left it off, and did his work without further inconvenience till July 15, on the next voyage, when he said the following occurrence took place:

He was shovelling coal in the ship's bunkers when his shovel caught on a plate on the floor of the bunker; he fell forward, dropping the shovel, and immediately felt great pain, and "something gave way in my inside." He made no complaint of it at the time to any officer, and said that the next day he told Donald, the second engineer, that he had a pain in the stomach; but that then

he did not tell him how he got the pain, or make any mention of an accident. He continued his work, though he said he had to have help from his companions, and "three days later (July 19) a large swelling came into my groin right down into the bag." He continued to work till he reached London, where he first made a complaint of rupture.

Dr. Lauzun Brown was the principal medical witness for the applicant; he said that in his opinion there was a congenital condition predisposing to rupture, and that the rest of the conditions started *de novo*, and all dated from the strain on July 15. He said the man told him that there was a "click" at the time, which was of great importance in deciding when the rupture occurred. That something then broke. No evidence of this "click" was given by the man at the hearing. He explained away the occurrence of a "lump" on June 15 by stating that there was then no real rupture at all.

Dr. Lauzun Brown's evidence was strongly contested by the respondents, who contended that the whole affair was of long duration.

The following was given in evidence, and is taken from the shorthand notes taken at the trial.

Dr. Brown said that the congenital form of hernia has no peritoneal covering over the internal ring, and that in consequence one source of resistance is taken away, but that Nature provided another.

When pressed as to the nature of the "lump" felt by the man in June, and as to the interpretation of the fact that it appeared when the man stood up and went when he lay down, and asked if that did not mean that it was on account of the hole being sufficiently open to allow it to come in and out easily, he said:

"I do not admit it was ever in the canal. It was trying to get in, but never got in. It must come through the canal. It may be arrested in any part of the canal; but if a complete rupture, it must come through."

It was pointed out to him that neither the word "canal" nor "complete" had been mentioned.

He replied: "If it is not in the canal there is no rupture until the canal is entered. I conclude that this was an incipient hernia trying to get through the canal, due to the arduous lifting nature of the man's work."

He was then asked to define the difference between a rupture which is very small and an incipient rupture.

"I say a complete rupture has many forms. A rupture is a breaking through. I say we have no sign of breaking through here. An incipient rupture means that the bowel at the particular point is forcing its way, and trying to get through the weakest part of the belly wall."

He was reminded there was no question asked as to a "complete hernia," and that this was an omental hernia.

He remarked that the "lump" was "just a lump of fat."

Again pressed as to the interpretation of the "lump," he said that it was "a hernia which is trying to get through the canal."

Q. "And which has got partly into it?"

A. "Which has got partly into it."

The JUDGE: "Do you assent to that?"

A. "No, I have tried to explain it. You have no evidence that this piece of fat had come through anything at this time. You have evidence that it was pushing something in front of it, and you cannot go further."

When further pressed as to the explanation of the "lump," he said it was "that a piece of fat gets down into that tube, not necessarily into the hole. That it made a lump outside the hole by trying to press through. It was not a hernia, but simply a little protrusion pressing against the weakest part of the wall."

He said that the great difference between the condition which he called the bowel "trying to get through" and a small hernia (in this case, which was of the congenital variety) was that though there might be all the other symptoms of a hernia, there "would not be the symptom of a click or breakdown."

He was then asked :

"If a man says, 'I have got a lump here' (over the internal ring), 'do you say it is not omentum nor a rupture?'"

A. "I do not say it is or is not. I have no evidence. I do not know that it is a rupture. It is a swelling which the man never had before."

Q. "And something which has come down in exactly the same spot as the rupture will occur later on? What will be the difference between the symptoms of hernia which occurred on June 14, and omentum coming down to the extent of  $\frac{1}{2}$  inch?"

A. "Symptoms of swelling, but not the symptom of the click or breakdown. One would certainly be the larger."

Q. "But if the same size, then the symptoms of July 15 would be precisely the same as June 14?"

A. "Oh no."

(Question regarding the size of the hole through which the hernia came.)

Q. "Supposing at the time of the operation it was found two fingers could easily go through that ring, does not that strike you as rather much to occur in a month?"

A. "It strikes me there must have been very considerable strain put on that."

Q. "That is not an answer. Does it not strike you as very extraordinary it all occurring in a month?"

A. "Yes, unless, as you say, there is a strain."

Q. "I did not say strain. Do answer my questions."

The JUDGE: "I think the doctor is giving his evidence very fairly, and is trying to make a difficult matter plain. It is very difficult to me."

(Question regarding the thickness of the walls of the sac.)

Q. "In a hernia which occurred for the first time on July 15 would you expect a month afterwards to find a very thick-walled sac?"

A. "Yes, in this case; for two reasons: The man had been continually at work, continually strained, and there is no reason why the sac should not be thick walled after a month subject to strain of that kind, or pressure of that kind. The second reason is that the canal in this case is described by the witness who did the operation (Dr. Ziervogel) as being much larger than usual. That is the internal ring. In a congenital hernia that is a very unusual condition."

Dr. Humphries supported Dr. Lauzun Brown's evidence, but in reference to the lump of June 14, when asked to explain it, said: "Either the omentum or the gut. I can suggest nothing else," and that if he saw the lump for the first time, "hernia is the first thing I should look for."

Dr. Cantley and Dr. Ziervogel's evidence for the employers stated that the man's condition, as found at the time of the operation on August 21, was as mentioned above. They were of opinion that the hernia was of far older date than that of the accident of July, 1907, for the following reasons, viz.: A large scrotal hernia to the bottom of the scrotum containing omentum; a very thick-walled sac and hole large enough to get two fingers through easily, the two rings being nearly approximated, and a congenital variety, were the characteristics of a hernia of long duration.

Deputy Judge Brooks found that there was no rupture on June 14, 1907, and that the man was ruptured *de novo* on July 15, and made an award in favour of the workman.

The case was heard without a medical assessor.

The employers, not being satisfied with the above evidence, made further inquiries, with the result that they made an application to set aside the award on the ground of fraud.

Dr. Sullivan, of Holloway Prison, gave evidence to the effect that he had examined the man in March, 1907, at the prison where the man was detained for a theft of lead. Dr. Sullivan found a left hernia, which was a fully developed hernia, and not a small one of the type sometimes called bubonocoele, as in every case where it was of the smaller type he always described it in his report as "bubonocoele," and not, as he had in this case, as "hernia."

Judge Smyly held that the employers had not proved that the applicant knew that this was a rupture when he swore that he had never been ill before July 15, 1907, and had never been ruptured before.

[*Chapman v. The Atlantic Transport*, Deputy Judge Brooks, Bow C.C. Local papers, January 27, 1908, and Judge Smyly, Bow C.C., July 23, 1908.]

*Notice of Rupture not given for Three Months—Employers Prejudiced by Delay in Giving Notice* (W.C.A.).—Hancock, the workman, had been employed for some time by the respondents, who dismissed him on October 2, 1908. He went to a doctor on October 11, to whom he showed a rupture, which he said had occurred on the preceding July 14. He gave written notice of the accident to his employers on October 13. He gave as his reason for not giving the notice before that he did not want to go on half-pay, so that the question of mistake was not open to him. He swore at the hearing that the accident was caused by carrying a heavy box with the assistance of three other men; that he felt a pain in his groin at the time, and did not tell the other men as he did not like to do so. He said he felt a lump coming down; he had never had a lump there before. He said he had told Pron, the foreman over him, and Pron admitted that Hancock did say to him one day: "I think I must have strained myself," but without reference to the box or that particular day. Hancock said that after the accident, on July 14, he worked till the

usual hour, returned home, told his wife, and laid down. He did not send for any doctor, and worked as usual ever since until discharged, nine days after which, for the first time—*i.e.*, in October—he saw Dr. Buckley.

Dr. Buckley gave evidence for the workman; he said he found on October 22, when he examined him, an inguinal hernia, easily reducible, but down into the scrotum. That it was impossible at that date to say how long he had been suffering from the condition he found, but that, in his opinion, it was not of very recent growth, and that it may quite possibly have originated at a period beyond the time given as the date of the accident. The condition prior to July 14 he thought was one of bubonocoele, or partially descended rupture, and the strain such as the one described by the man would be sufficient to bring about the complete descent.

He was further of opinion that the man could not work in his present condition without a suitable truss or an operation for the cure, but that with a truss, or after successful operation, he would be able to do the same work as hitherto without any risk.

The employers called the three men who were said to have carried the box with the workmen on July 14, and they said they had no recollection of carrying such a box.

Dr. Milne gave evidence for the employers, and said that, in addition to the rupture, the man had inflammation of the kidneys, which would militate against his general good health.

He said that he had examined the applicant, who alleged that on July 14, as he was helping three other men to carry a heavy iron box, he felt a bit of a "twitch" near the right groin, but that he continued his work, not only on that day, but until October 2 (over eleven weeks), when he was discharged owing to slackness of work, but that he did not go to a doctor till nine days later, and even yet has not had any treatment. On examination, Dr. Milne found that the man has a right scrotal rupture or inguinal hernia. "This, in my opinion, is of much longer standing than July 14; it is easily reducible, has never been strangulated, and has a thicker sac than would be acquired in the time named. Further, he has a slight fulness showing a natural weakness on the left side also, which is likely to develop into a rupture unless supported. I am of opinion that his present condition is the result of a natural weakness gradually developed, and is not to be attributed to any accident."

The County Court Judge, in giving judgment, said: "I find employers not prejudiced by want of notice. I find that the accident did occur. I find that the injury was caused or accelerated or intensified by the accident," and he made an award in favour of the applicant.

From this award the respondents appealed.

COZENS-HARDY, M.R.: "This accident was said to have taken place in July, 1909. The workman did not leave his work, but on October 2 he was discharged because work was slack. It was only then he went to a doctor on October 11. On October 22 he issued process for arbitration, and at the hearing the County Court Judge came to the conclusion that there was evidence that the workman was injured by accident on July 14. There was evidence, though the case was one that would provoke the gravest suspicion. But in



face of what the workman said in his evidence, and in face of what his wife said, there was some evidence that an accident happened to him on that date. The workman had given to the employers no written notice of the accident, and therefore the only question for us is, whether the employers were prejudiced in their defence by the want of such notice, or whether such want was occasioned by mistake within the meaning of proviso (a) to s. 2 (1) of the Act. The question of mistake is too clear for argument. The workman in his evidence deliberately said that he did not want to go on half-pay. But were the employers prejudiced in their defence? The burden of proving that they were not prejudiced lay upon the workman. In face of the evidence given by the workman's doctor, as well as by the employers' doctor, is it possible to say that the employers were not prejudiced in their defence by the fact that they did not receive notice of the accident until after the workman had been discharged? If the doctors had been consulted earlier, they would have been able to say whether the man's condition arose from the accident on that date. It is true that they said that there was a rupture, but the workman's doctor said that he was of opinion that it was not of a very recent growth, and that it might quite possibly have originated at a period beyond the time given as the date of the accident, whilst the employers' doctor was of opinion that it was of a much longer standing than the date alleged, July 14. We think there was no evidence to justify this finding that the employers were not prejudiced in their defence by the want of notice of the accident. The appeal, therefore, will be allowed."

[*Hancock v. British Westinghouse Electric Company*, 3 B.W.C.C. 215.]

## 2. RUPTURE EXISTING BEFORE THE ACCIDENT, AND RENDERED WORSE BY IT.

*Rupture* (W.C.A., County Court).—A workman who was slightly ruptured was picking chalk out of a quarry, and was pulling out "a tidy lump out of the usual size."

His Honour JUDGE TINDAL ATKINSON said: "I think, regarding the case solely from the medical aspect, the injury could not have been an untoward event not expected; but since *Fenton v. Thorley*, in my opinion, the workman is entitled to an award in his favour, on the authority of that case."

The accident happened on August 9, 1907. In the middle of August he was operated on in Guy's Hospital for radical cure with complete success, and the Judge held that total incapacity had ceased by December 11, 1907, and from that date incapacity was partial only; but no evidence was offered as to when the workman was able to obtain employment.

[*Fulford v. Northfleet Coal Company*, Judge Tindal Atkinson, *Grays Thurrock C.C.*, 1 B.W.C.C., 222.]

*Rupture: New Rupture in a Man "cured" of an Old Rupture* (W.C.A., County Court).—The workman frequently moved planks, and never had any difficulty before the day of the accident, upon which a plank had become frozen to another, and in straining to move it he fell down in pain, ruptured. The County Court Judge found that the

applicant had been ruptured previously, and that upon the evidence he was practically cured (*sic*) of his old rupture, and was as good a man as he was before it.

[*Timmins v. The Leeds Forge Company, Ltd.*, 1899, 16 T.L.R., 521; 2 W.C.C., 10.]

### 3. OPERATION.

*Rupture, Double: Reasonable Refusal to undergo Operation* (W.C.A.).—At the Southampton County Court, the applicant, a sailor, said that he met with an accident on board ship, which resulted in double rupture (*sic*). He was supported by Dr. Lauzun Brown of London, who advised him not to submit to the operation for cure suggested by his employers.

COZENS-HARDY, M.R.: "He is not a young man; and he is suffering from kidney disease, as I understand, in a very bad form—that is to say, Bright's disease. . . . The test is whether the workman in refusing to undergo the surgical operation acted unreasonably. I altogether decline to say that, in a case of an operation of this kind, a workman can be said to act unreasonably in following the advice of an unimpeached and competent doctor, even though, on the balance of medical evidence given at a subsequent date, the learned County Court Judge might hold that the operation was in its nature one which might reasonably and properly be performed."

Held: "The workman was reasonable in his refusal."

[*Tutton v. Owners of the s.s. Majestic*, 25 T.L.R., 482; 2 B.W.C.C., 346.]

*Refusal to undergo Operation; Workman's own Doctors disagree; Reasonable Refusal* (W.C.A.).—The workman, Thomas, for seven years received compensation for a rupture which was held to have been due to an accident. The rupture was large and irreducible. His employers then applied for a review on the ground that his present condition was no longer due to the accident, but to his unreasonable refusal to undergo an operation. They called two doctors, who agreed that the operation was practically safe and likely to be successful. They said: "It may get larger at any time and become strangulated, in which case an immediate operation would be demanded, and there would then be a good deal of risk. . . . The risk of recurrence after the operation is about 3 per cent." The workman also called two doctors, one of whom had recently seen him, and who agreed with the employers' doctors; the other, Dr. Davies, who had attended him on and off for seven years, said that he had advised the workman not to undergo the operation. He said: "His age is against a cure being successful. His abdominal walls are fat, and he is very nervous. I do not think the risk of strangulation so great as the risk of an operation."

The County Court Judge found that the workman had not behaved unreasonably in taking the advice of the one doctor and in refusing to undergo the operation.

The employers appealed, but the Court refused to disturb the award.

[*Ruabon Coal Company v. Thomas*, 3 B.W.C.C., 32.]

NOTE.—By this case, if one of the doctors for the workman advises against an operation, the workman cannot be called unreasonable in

refusing the operation unless the doctors can be themselves shown to have displayed lack of *bona fides*.

#### 4. CAPACITY TO WORK WITH RUPTURE (AFTER OPERATION, OR WITH A TRUSS).

*Ruptured Seaman ; able to work with Truss ; Open Award (W.C.A.).*—The workman, a seaman, was ruptured by an accident, and was therefore obliged to wear a truss. On an application by the workman for compensation the County Court Judge, having heard evidence, referred the following questions to the referee :

“(A) On June 24, 1909, personal injury was caused to Michael Griga by accident arising out of and in the course of his employment under the following circumstances : The man fell from aloft, but was caught by his left foot in the rigging.

“(B) The matter on which I am satisfied that it is desirable to obtain a report is : For the applicant it is stated that he has sustained a rupture, which renders it unsafe for him to follow his employment at sea, whether he wears a truss or not, and there are indications of traumatic-osteo-arthritis in the left hip-joint. For the employers it is suggested that, notwithstanding the rupture, he is quite fit to do his work as a seaman if he wears a truss, and that there are no signs of arthritis. Which is the correct view in your opinion ?

“(C) Such matter seems to be material to the following questions arising in the arbitration, viz. : whether the man is fit to do his work as an A.B., or whether he is fit to do any work.”

The medical referee gave the following answer to these questions : “I report on (B) that Michael Griga is quite fit to do his work as a seaman, notwithstanding the rupture, provided he wears a proper truss ; that he is not suffering from traumatic-osteo-arthritis. On (C) that Michael Griga is fit to do his work as an A.B., provided he wears a proper truss. I recommend that Griga be supplied with a proper truss by Critchley, 18, Great George Street.”

On receiving this report, the County Court Judge gave the following judgment : “Without laying down any great principle as to what should be done in awarding or not a nominal sum where there has been a rupture, I see no reason in the facts of this particular case to award such a sum. I see no reason to anticipate any recrudescence of incapacity from this rupture if the man takes the proper precautions which it is his duty to take ; and, having regard to the report of the medical referee, I award in favour of the respondents.”

From this award the workman appealed.

COZENS - HARDY, M.R. : “It is unfortunate that the case of *Morgan v. The Owners of the Vessel Tynnon*, 1909, 2 K.B., 66 ; 2 B.W.C.C., 406, which was heard in March, and reported in the month of July, 1909, was not brought to the notice of the County Court Judge when he heard this case. Had he had the opportunity of considering that case, his decision would have been different. In my opinion this Court has distinctly laid down a principle from which we should not depart, that in a case of this kind, where a man has been ruptured, though by wearing a truss he may be physically

able to earn full wages, still the circumstances are such that there is a possibility, if not a probability, that in the future there will be bad effects resulting from the accident which will affect his earning capacity. So in such a case there should be a suspensory award of one penny a week. The medical referee said: 'I recommend that Griga be supplied with a proper truss by Critchley, 18, Great George Street.' There is an immediate expense which the medical referee says ought to be incurred. I think, therefore, that this appeal must be allowed, and a suspensory award made for one penny a week."

[Griga v. The Owners of s.s. *Havelda*, 3 B.W.C.C., 116.]

*Seaman wearing Truss* (W.C.A.).—See above, *Tynron v. Morgan*, where a seaman was found to be able, when wearing a truss, to return to his full work as an A.B. (*Tynron v. Morgan*, p. 1053).

## SKIN.

The symptoms of injury or disease which appear especially in the skin, will be found classified under the title of the cause of the trouble—*e.g.*, Brain, Nerves, Neurasthenia, Poisons, etc. Special injuries of the skin will also be found under the sections on Cold, Electricity, Heat, etc.

*Dermatitis: Caustic Alkalies* (W.C.A., County Court).—Dermatitis brought on by washing cans with a solution of caustic soda.

Held not to be an accident. This case was heard under the W.C.A., 1897. Under the third schedule of the W.C.A., 1906, this form of dermatitis is included.

[Cheek v. Harmsworth Brothers, 1901, *Times*, October 10, 4 W.C.C., 3.]

*Eczematous Ulceration: Wet Sand* (W.C.A., County Court).—This disease was brought about by the man working in water and wet sand, which got into his boots. The claim was brought on the ground that it was a scheduled disease. The schedule includes any process in which the disease is caused by "dust." On the strict interpretation of the Act, the County Court Judge nonsuited the applicant, as he felt bound to hold that wet sand was not dust.

[Bevan v. The United Westminster Colliery Company, Wrexham C.C., Judge Moss, 1909, *Policy Holder*, xxvii. 192.]

*Dermatitis: Carbolic Acid* (W.C.A.).—The applicant was washing paint with a fluid containing considerably less than 1 per cent. of carbolic acid in water. He said when he finished that "his hand was seriously burnt." Matson was seen by two or three of the crew a week after the voyage, and he then said nothing of his fingers having been burnt, nor did his hands show any signs of burns. Evidence that the fluid was harmless was given by the respondents, in favour of whom His Honour made an award.

[Matson v. Owners of the s.s. *Philadelphia*, Bow C.C., Judge Smyly; March 21, 1908.]

*Skin: Alleged Injuries (W.C.A.).*—The applicant said that about December or January a trolley caught him on the right shin, in consequence of which his leg was injured, and he was unable to work for fifteen weeks. He said he thought the accident was on January 6, and that prior to that date his leg was not "exactly as it should be." He admitted that up to January 3 he had been treated by Dr. Williamson for swelling of the leg. Medical evidence was called to prove that he had made no complaint of an accident when admitted in the infirmary, and that he was suffering from *another disease* all the time.

[*Lord v. Schumacher, Woolwich C.C., Judge Willis. Local papers, July 10, 1908.*]

*Skin: Loss of Personal Appearance through Treatment by a Beauty Specialist — Negligence.*—Three smallpox marks appeared on the plaintiff's nose. These were treated by a beauty specialist, and the medical evidence was that, in consequence of the treatment, there would be a bigger scar on the nose than before. The jury said there was fraud. Damages £500.

[*Heath and Wife v. Lavin, King's Bench, Ridley, J., and special jury, 1908, Times, November 6.*]

*Skin: Barber's Itch (Ringworm of the Beard) — Negligence.*—On October 9, 1907, the plaintiff went to the defendant's shop to be shaved. He was there cut slightly on the skin of the throat, and very soon afterwards the cut became inflamed. His doctor examined him on October 12, and found distinct ringworm on his neck. Two other witnesses said that they had contracted the same disorder and had been shaved in the same shop.

CHANNEL, J.: "The fact that this barber's rash appeared soon after the plaintiff had been cut, and in the near neighbourhood of the cut, is evidence that the disease was contracted in the defendant's shop from the use of something which was infected—a razor, or a towel, or some other appliance. It is clearly evidence of negligence in a barber to use appliances of this kind, which have already been in use on other persons, without taking means to insure that they are thoroughly cleansed. So in the case of a razor. It is evidence of negligence in a barber not to keep his razors clean."

Damages 10 guineas.

[*Hales v. Kerr, Divisional Court, Channell and Sutton, JJ., on appeal from Kingston C.C., 1908, 2 K.B., 601.*]

*Cut Finger—Eczema—No Accident (W.C.A.).*—The applicant, a hairdresser's assistant, claimed compensation for incapacity due to eczema, which he alleged was due to infection, by a lotion which he was using for shampooing, of a cut which he received as an accident. The cut was on his hand, a mere "snip," which he got when at work.

Some time subsequent to the cut he developed eczema of the hand and arm, and a month after the alleged injury he went to a doctor, to whom he made no complaint of any injury. He was subsequently discharged by his master, and when he wrote to his master he did not mention any accident.

Held: "The eczema was not caused by any accident, and, further, that the disease was not due to the shampooing lotion."

[*Barnell v. Woodham*, City of London Court, Judge Lumley Smith, 1909, 1xx. *Post Magazine*, 6.]

[NOTE.—In this case the applicant's claim was founded on an accident, and he did not elect to proceed under the third schedule of the Workmen's Compensation Act; but the Judge held that he had no claim even under the schedule.]

*Keloid — Negligence.* — The plaintiff, a lad of fifteen, was run down by one of the omnibuses of the defendants. He was dragged along the road, and in consequence lost the skin of part of his leg. Skin grafts were applied from his other leg at Guy's Hospital. The result was that keloid developed in the scars. The medical evidence for the plaintiff was: "That this was a disease of a cancerous order, and there was only one previously known case in medical history" (*sic*). It further stated that the disease was incurable, and might be tuberculous.

The medical experts for the defendants agreed that it was incurable, but not that the case was nearly unique.

The damages were agreed at £75.

[*Davis v. The Great Eastern Motor-Bus Company*, City of London Court, Judge Lumley Smith, *Times*, July 20, 1909.]

### Operation.

*Skin-Grafting (W.C.A.)*. — An operation was performed immediately after the accident, and at a later date a second operation for skin-grafting was necessary. The applicant's hand had lost most of the skin by a machinery accident. Though it is not reported, FLETCHER MOULTON, L.J., during the hearing of this case, remarked: "Many operations have to be done twice: could you have a better example of an operation which has to be done twice than this one?"

[*Shirt v. Calico Printers' Association, Ltd.*, 1909, 2 K.B., 51; 2 B.W.C.C., 342.]

### Disease existing before the Injury.

*Tubercular Skin Disease, not aggravated by Accident (W.C.A.)*. — The applicant, an undersized man, had suffered for many years with tubercular disease of the skin. He had had various operations, and he was left with a large area of scar tissue on the outer side of the right thigh, which was 3 by 4 by 2½, and oval in shape. He claimed that he had been kicked by a horse on the wound, and that in consequence he was incapacitated from following his employment as a stableman. At the time of the arbitration the wound had been completely healed for a long time, but the superficial scarred area was thin and blue. He said that previous to the kick, in spite of the extensive destruction of the skin and deeper tissues, and in spite of the fact that the skin was adherent to the bone and deeper structures, both of which his own medical man admitted he had before the injury, yet he said he had felt no pain in the scar except after the kick. This his own medical expert regarded as a thing

which one would not have expected, but he said that, though the scar was adherent before it was kicked, it was slightly more adherent now, and that there was a slight increase in the superficial area of the scar. These two were, in the opinion of his experts, the chief reasons for his being less able to work since the injury than before it. The case was heard before a medical assessor, who found that the man was suffering from an old tubercular disease of the hip, which rendered him incapable of any but light work. He also found that the tubercular disease had not been rendered worse by the injury.

[*Dubbins v. Covington and Sons, Wandsworth C.C., Judge Harington*; award made on November 29, 1909.]

## SPINE.

Many cases of injury to the spinal cord which are claimed to produce railway spine, etc., are also collected under the head of Neurasthenia.

Spinal cord injuries may have various results :

1. Injury to the bones.
2. Injury to the spine without the bone.
3. Disease in consequence of the injury.
4. Disease which existed before the injury, and is aggravated by it.

### 1. Injury to the Bones.

*Spine: Partial Dislocation and Neurasthenia — Negligence.* — On July 1, 1906, the plaintiff was injured in a railway accident at Salisbury. She had four ribs broken on the left side. She sprained her ankle, and was covered with bruises from head to foot. She had partial dislocation of the bones of the neck (the presence of which dislocation was denied by Sir Victor Horsley and Dr. Pearce Gould). She also said she suffered from neurasthenia. Damages £7,000. (Not reduced on appeal on the ground of excessive damages.)

[*Macdonald v. The London and South-Western Railway Company, 1909, Times, January 26.*]

*Spine, Broken; Death (W.C.A.).*—The applicant's foot slipped, and he fell, from stepping on one of the logs of a floating raft, and in consequence fractured his spine. (This case is quoted merely as an example of serious injury from a very slight fall.)

[*Kent v. Samuel Norton and Sons, Clerkenwell C.C., Judge Edge, 126 L.T.J., 234; July 11, 1909.*]

*Spine: Dislocation.*—The applicant, while walking across his employer's yard, which was covered with asphalt, was seized with an attack of syncope, and fell. He sustained a fracture of the skull and dislocation of the vertebræ of the neck. It was argued that the asphalt pavement was of itself specially dangerous, and that in consequence the master was liable. For the defence it was argued

that, though the accident happened in the course of the employment, it did not arise out of it, a contention which was supported by the finding of the arbitrator. The evidence was, that in all probability the accident would not have happened if he had fallen on some soft substance, such as sawdust or feathers—that was to say, the accident happened, not because the man fell on something which was extraordinarily hard, but because he fell on something which was not extraordinarily soft.

Held: "The accident did not arise out of and in the course of his employment."

[*Stanton v. Townshend*, Clerkenwell C.C., Judge Bray. Local papers, May 28, 1909.]

## 2. Injury to the Spine without the Bone.

*Damage to the "Spinal Marrow."*—This caused weakness and inability to walk properly, in consequence of wasting of the muscles of the right leg. The plaintiff was thirty-six years of age and had been for five years a steward on a P. and O. liner, when his wages were £3 per month and his keep. (Estimated with the tips at £120 to £150 per annum.) The plaintiff asked for an assessment of damages on the basis of inability to work in the future. Damages £2,000.

[*Daniel v. The Great Northern Railway Company*, King's Bench, Darling, J., and special jury; *Times*, February 25, 1909.]

*"Spinal Concussion"* (W.C.A.).—A workman, while ascending a ladder, slipped and fell to the bottom of the lower hold of a steamer, a depth of about 30 feet. He sustained "spinal concussion," which, he claimed, totally incapacitated him for any further work from November 26, 1907, till November, 1908, and still continuing.

[*Scott v. Owners of s.s. Monte Videan*, Judge Shand, 126 L.T.J., 55.]

*"Spinal Concussion"*—*Negligence.*—Some six months ago the plaintiff had just got his foot on the step of a tramcar, when he was thrown off by the jerk caused by a sudden start. His head was cut; he was bruised and rendered unconscious. His doctor said he was suffering from concussion of the spine, and would suffer from it for a long time afterwards. The plaintiff was a small dealer in rabbits, cat's meat, etc., and said he lost £16 during the time he was laid up—namely, two months. Damages £40.

[*Oddie v. West Ham Corporation*, Bow C.C., Judge Smyly, and jury. Local papers, March 7, 1908.]

## 3. Disease in Consequence of the Injury.

*Spine: Spastic Paraplegia* (W.C.A.).—The applicant, a ship's mate, was washing down the deck of the ship on December 5, 1908, when he slipped and fell backwards, bruising his back and his elbow. He was given some liniment to rub his back and his elbow, and when he reached Chatham on December 23, 1908, he found his legs and arms "feel queer." After Christmas his legs were very "numby," and in the course of a voyage a few days later, on the way to Devonshire,



his legs got so much worse that at Cowes the captain put the ship in, and got a doctor, who sent the man home, where he saw his own doctor. He was suffering from a disease called "spastic paraplegia," which produced rigidity in the legs, with loss of control over them. Dr. Gange, who had known the man for years, as he was one of his club patients, said that he was quite healthy before the accident, with the exception that in October, 1907, he broke his shoulder-bone. About Christmas, 1908, the man came to his surgery, and complained of numbness of the legs, but it did not appear to be serious, so he sent him back to work. In his opinion the accident was the cause of the condition, and the man would not get well. No medical evidence was called to contradict this. His Honour awarded 15s. per week.

[Lambkin *v.* Owners of the ship *Goldfinch*, Faversham C.C., Judge Shortt. Local papers, April 24, 1909.]

#### 4. Disease which existed before the Injury, and is aggravated by it.

*Spine : Syringomyelia* (W.C.A.).—The applicant, whose usual occupation was that of a platelayer, was put to the work of hedge-trimming, and he claimed that while he was so employed he met with an accident which incapacitated him. He said that, as he was trimming a hedge with a long-handled hook about four or five o'clock in the afternoon, he felt a jerk in his shoulder, after which he could not work. Some days after this his doctor gave him a certificate for a dislocated shoulder. For some long time before this he had not done his proper work as a platelayer, as his hand got swollen and cold, and had not proper grip. This he attributed to an old accident of eighteen years ago, which had prevented him from moving his thumb.

Evidence was called to show that he had complained of his arm being stiff some time before the accident.

He was eventually found to be suffering from a congenital and very rare disease, syringomyelia, which in this case, by affecting the nutrition of the shoulder-bones, caused gradual erosion of the shoulder-joint, and so rendered dislocation not only easy, but inevitable. "The tendency was that the nerves of the arm would get weaker and weaker." The position in which Wiseman held his hand at the time of the arbitration was typical of "claw-hand" (see Fig. 145).

His Honour, in a most carefully considered judgment, found that there was no particular strain, no over-exertion, and that the development on the day mentioned was the ordinary natural result of the disease, which was of a progressive nature, and which some time or other must have resulted in what it did on December 6. He in consequence made an award in favour of the employers.

[Wiseman *v.* The Colne Valley Railway Company, Halstead C.C., Judge Tindal Atkinson. Local papers, November 26, 1908, and January 29, 1909.]

*Locomotor Ataxy accelerated by a Compound Fracture of the Right Leg* (W.C.A., County Court).—On November 8, 1902, the applicant,

a signalman, tripped over a wire, and in falling to the ground suffered a compound fracture of the right leg. The applicant was at the date of the accident suffering from a progressive nervous disease known as "locomotor ataxy." The bones would have been completely healed, and the applicant able to return to work, before May 23, 1902. The question was, Has the progress and intensity of the disease been accelerated and aggravated by the occurrence of the accident and its consequences?

The doctors said: "We found that, immediately after the accident, the disease had made a sudden 'leap' in advance, involving such serious inco-ordination that the man has ever since been totally incapacitated, being unable to walk without crutches."

The Judge said: "The probabilities appear to me to point to the conclusion that the sudden change for the worse in his condition is sufficiently accounted for by the accident, and in no other way, having regard to all the circumstances of the case."

Held: "The acceleration of the locomotor ataxy was part of the consequences of the accident."

[*Willoughby v. The Great Western Railway Company*, 1904, 117 L.T.J., 132; 6 W.C.C., 28.]

## SPLEEN.

The editor has not been able to discover any cases of accident to the spleen.

## STOMACH.

### Disease existing before the Accident, and aggravating its Effect.

*Bursting of Bloodvessels in the Stomach—Accident* (W.C.A.).—The workman, in order to start a gas-engine, had to turn a large wheel. During the attempt some bloodvessels burst in his stomach, and he died. A post-mortem examination was made, "and the medical evidence showed that the deceased man had been suffering from chronic indigestion, which had weakened the bloodvessels of the stomach and intestines, and there was evidence of congestion and inflammation. The Judge came to the conclusion, upon the medical evidence, that disease, and not accident, caused death."

NOTE.—This case is now considered to be overruled by *Fenton v. Thorley*, and therefore is now an instance of the consequence of an accident.

[*Hensey v. White*, 1899, 16 T.L.R., 64; 2 W.C.C., 1.]

*Cancer accelerated by Accident* (W.C.A.).—On March 2, 1908, Thomas Jones, a groom, while attending a sick horse for his master, a veterinary surgeon, was suddenly attacked by the animal, which grabbed him by the shoulder with its teeth, threw him upon the stable floor, and then kicked him on the body until he was unconscious. Jones was laid up six weeks; he twice collapsed at work, and subsequently died on July 2. At the post-mortem he was found to have had a cancer of the stomach, which the medical men for the

applicant said had been accelerated, even if it had not been caused, by the injuries. The employer's doctors were of opinion that the cancer was the cause of death, and was not affected by the injury.

His Honour found that death was accelerated by the shock of the accident, which must have increased and aggravated the disease, if it did not set it up.

[*Jones v. M'Laren*, Liverpool C.C., Judge Shand, 1908, *Policy Holder*, xxvi, 880.]

## SUPRARENAL GLANDS.

The editor has not been able to find any cases of injury to the suprarenal glands.

## TEETH.

*Tooth broken—Negligence, and Sale of Goods Act.*—The plaintiff bought a bun, and bit on a stone in it which broke his decayed tooth, and in consequence he had an abscess in his jaw. He claimed that the presence of the stone proved negligence in the baker, and that there was an implied warranty that the bun "should be reasonably fit" for the purpose of being eaten. The jury found that there was no negligence, and that the bun was reasonably fit and of merchantable quality; but the Court of Appeal ordered a new trial.

COLLINS, M.R., said that, speaking for himself, he should be inclined to say that such a bun was not reasonably fit for mastication. "The unexplained presence of the stone is *prima facie* evidence of negligence on the part of the person who made the bun. . . ."

[*Chapronière v. Mason*, 21 T.L.R., 633.]

*Operation* (W.C.A., C.A.).—The injured workman requested that a decayed and painful tooth might be removed during the anæsthesia administered to him for an operation rendered necessary by an accident to another part of his body. Just as the workman was recovering from the effects of the anæsthesia, the surgeons remembered this bad tooth, and again anæsthetized the man, who died before he recovered consciousness.

Held: "The masters were not liable for the second operation, and death, which might be due to failure of respiration, which was at least as probable as that his death resulted solely from a spasm induced by an attempt to swallow oozing blood in his mouth."

[*Charles v. Walker, Ltd.*, 25 T.L.R., 609.]

NOTE.—This case is further discussed under *Operation* at p. 25; it is only quoted here in reference to the oozing of the blood from the mouth after the extraction of the tooth.

## TENDONS.

(SEE ALSO FASCIE AND MUSCLES.)

Miner's wrist, which is a condition of inflammation of the tendons of the wrist, is included in the third schedule of the Workmen's Compensation Act.

*Tendons and Muscles cut ; Bad Union—Lump Sum (W.C.A.).—*O'Neill, a ship's stoker employed by the respondents, had a portion of his hand injured when at work.

He was paid full compensation for some time at the rate of 17s. 3d. per week. The solicitors to the two parties, employers and workman, then agreed that £175 as a lump sum would be sufficient to redeem the liability of the employers for the weekly payments.

The Registrar refused to register on the ground of the medical report of Dr. Billington put in before him, and the case came before His Honour.

O'Neill was called, and with his injured hand wrote his signature, apparently without difficulty. He, however, stated that he had completely lost his grip, and could not perform his old work as a stoker.

He further stated that he was willing to settle for the amount stated, the company to pay the whole of the costs.

COZENS-HARDY, M.R.: "I think in this case, as far as we can gather from the somewhat inadequate information we have had supplied to us, the learned County Court Judge has misdirected himself. He has really assumed that the man was entitled, and must continue to receive, 17s. 3d. a week for the rest of his life; and on that footing, having regard to the age of the man, he apparently worked out a calculation which induced him to think that £175 was not a reasonable sum. The foundation of that proposition fails. It is a fallacy to say that the man must continue to receive 17s. 3d. a week, which was the full amount he could possibly claim. The amount would almost certainly have been reduced if the employers had thought fit to take out an application, which they would do if this order stands, to reduce the amount of compensation.

"Without infringing on the right of the learned County Court Judge, in the absence of the misdirection, to decide whether an agreement is reasonable, I think here it is clear that he obviously misdirected himself. Not only was there no evidence of inadequacy, but the man's solicitors—he was being represented by solicitors who were doing the best they could for their client—have come to the conclusion that £175 is a fair sum to accept.

"Therefore I think we ought to discharge the order of the County Court Judge, and order this agreement to be registered."

Fletcher Moulton and Farwell, L.JJ., agreed.

[O'Neill v. The Anglo-American Oil Company, Ltd., Blackburn C.C., Judge Hans Hamilton; 2 B.W.C.C., 434.]

*Ununited Tendons—Lump Sum (W.C.A.).—*The applicant, when working with glass pickle-jars, by breaking one, cut through the tendons in the left wrist. Though the tendons were sutured by a doctor, they failed to unite completely. The result was a great loss of power in the middle and little fingers of the left hand, but there was no loss of feeling.

The wages had been 13s. 6d. a week before the accident, and compensation had been paid for a considerable time. A sum of £63 was agreed by the master and servant as being sufficient to redeem the weekly payments, but the Registrar refused to

register the memorandum, and the Judge held that the sum was inadequate.

[*Allen v. Mainwaring*, Lambeth C.C., Judge Emden; decided October 12, 1909.]

## TETANUS.

*Tetanus an Accident* (W.C.A.).—"Tetanus is a disease, but would anybody contend that it is not an accident causing damage?"—LORD HALSBURY (*obiter dictum*) in *Brinton v. Turvey*, 1905, 21 T.L.R., 445.

*Tetanus* (W.C.A., Irish).—A gardener whilst digging in his employer's garden was injured by a nail piercing his foot through his boot. He subsequently died of tetanus, which was held to have infected the wound. It was found that persons working in stables and gardens are peculiarly subject to contract this disease if suffering from any wound, and that the tetanus germ entered the wound while the gardener was doing his gardening work.

The accident happened on March 23, 1907. Tetanus diagnosed about fourteen days afterwards.

[*Walker v. Mullins*, 1908, 42 Ir. L.T., 168; 1 B.W.C.C., 211.]

## THROAT.

*Diphtheria; Drainage—Negligence.*—The plaintiff claimed £52 damages, saying that she had caught diphtheria while in the employ of the defendant, some four days after she had complained of bad smell in the kitchen owing to offensive matter and defective trapping in the pipes. There was some dispute as to whether it was diphtheria at all. His Honour held that, though the smell was caused by defective drainage, the plaintiff had not proved that the smell arising from those defective drains arose from such a cause as the defendant with reasonable care could have remedied. He also accepted Dr. Grant Wilson's evidence that the smell from bad drainage could not cause diphtheria, though living in bad smells would reduce vitality, and render a person more liable to the attack of the diphtheritic germs. Judgment for the defendant.

[*Taylor v. Elliot*, Bromley C.C., Judge Emden; *Bromley Chronicle*, July 9, 1908.]

*Diphtheria; Infection—Nuisance.*—*Vide supra*, *Infection*, p. 966.

## THYMUS.

Sudden death has been found to be associated with a persistent thymus gland, which was said to have caused the death.

A persistent thymus gland has been found in cases of death from anæsthesia. Such a case was mentioned in the Transactions of the Medico-Legal Society, vol. vi., p. 239, though it was apparently associated with the status lymphaticus.

**Persistent Thymus Gland ; Alleged Cause of Death—Manslaughter.**—The prisoner was charged with the manslaughter of his wife under the following circumstances : He came to his home and had a violent quarrel with his wife. She ran out of the house, followed by him, abusing and threatening her. She fell down in the road, whereupon he kicked her on the arm, and she died.

With the exception of the bruise upon her arm, there was no mark of violence upon her body, and the doctors for the prosecution said this injury was insufficient to cause her death, but that she had a thymus gland which, instead of disappearing in childhood, had persisted, and was 2 inches long and 2 ounces in weight. Counsel for the prisoner claimed that this gland caused her sudden death, which he said was totally unconnected with the kicks or fright.

RIDLEY, J., in directing the jury, informed them that if the death was due to the fright caused by such illegal acts as threats of violence, even without physical contact, that would be sufficient to enable them to convict the prisoner.

Verdict, Guilty ; sentence, three months' hard labour.

[*Rex v. Hayward*, Maidstone Assizes, Ridley, J. ; *Times*, November 19, 1908.]

## TRACHEA.

For cases of injury to the trachea, see Throat and Lungs.

## TROPICS.

### Insurance.

Restrictions on voyage or residence in the tropics are common in insurance policies, or, rather, were more common many years ago than they are now.

*Sunstroke.*—Words of policy : “ Should sustain any personal injury from, or by reason or in consequence of, any accident which should happen upon any ocean, sea, river, or lake.” Insured died from sunstroke in the Cochin River.

Held : “ Death did not result from accident within the policy.”

COCKBURN, C.J. : “ His death must be considered as having arisen from a natural cause, and not from an accident.”

[*Sinclair v. Maritime Passengers' Assurance Company*, 30 L.J., Q.B., 77.]

### Nuisance.

*Sunstroke ; Illness Aggravated by Noise—Nuisance* (American).—The plaintiff was lying ill with sunstroke, and claimed that his recovery was delayed and convulsions caused by reason of the persistent ringing of a bell in the Roman Catholic Church which was across the road, in the crowded town of Provincetown. He claimed the ringing was a nuisance.

KNOWLTON, J. : “ The right to make a noise for a proper purpose must be measured in reference to the degree of annoyance which

others may reasonably be required to submit to. In connection with the importance of the business from which it proceeds, that must be determined by the effect of noise upon people generally, and not upon those, on the one hand, who are peculiarly susceptible to it, or those, on the other hand, who by long experience have learned to endure it without inconvenience; not upon those whose strong nerves and robust health enable them to endure the greatest mental disturbances without suffering, nor upon those whose mental or physical condition makes them painfully sensitive to everything about them. . . . If one's right to use one's property were to depend upon the effect of the use upon a person of peculiar temperament or disposition, or upon one suffering from an uncommon disease, the standard for measuring it would be so uncertain and fluctuating as to paralyze industrial enterprises. . . . There is no evidence of express malice. . . . The plaintiff's claim rests upon the injury done him on account of his peculiar condition."

Judgment for defendant. . . .

[*Rogers v. Elliott*, 146 Mass., 349, 1847, 4, Am. St. Rep., 316.]

### Workmen's Compensation Act.

With the exception of seamen, this Act does not apply to accidents outside the British Isles. Death at Malta, to a workman who had contracted in England with an English firm was held to be outside the Act (*Tomalin v. Pearson*, 2 B.W.C.C., 1).

Accidents which are of a tropical nature, such as sunstroke, etc., have been held to be within the Act when they occurred to seamen abroad and to workmen in the British Isles.

*Poisonous Bites or Wounds.*—Bites from poisonous snakes in England, though not correctly described as tropical accidents, are more conveniently collected here. A workman injured by such would, it is probable, only succeed if the nature of his work specially exposed him to such a risk; e.g., a dock hand unpacking bananas on board ship might be bitten by a concealed snake: it is submitted that he would have a right of action. A sailor sent on shore in the tropics for the ship's purposes, and injured, if specially exposed, would probably recover compensation. But if no such exposure was proved, then the injury would probably not be within the Act.

The judgment in *Craske v. Wigan* supports this view; in that case the injury was due to avoiding a cockchafer. (*Vide supra*, *Eye*, p. 943.)

COZENS-HARDY, M.R., said: "I think that it would be dangerous to depart from that which, so far as I am aware, has been the invariable rule of the Court of Appeal since these Acts came into operation—viz., to hold that it is not enough for the applicant to say, 'The accident would not have happened if I had not been engaged in this employment or if I had not been in that particular place.' The applicant must go farther, and must say, 'The accident arose because of something I was doing in the course of my employment or because I was exposed by the nature of my employment to some peculiar danger.' Unless something of that kind is established the applicant

must fail, because the accident is not one arising out of and in the course of the employment.

*Sunstroke*—"Accident" (W.C.A., County Court).—The employer admitted it was a case of sunstroke, but argued it was not an accident. The Judge said: "Two men were working together; one had the misfortune . . . to be struck by too much heat of the sun; the other by his side went free. In other words, one accidentally got more heat than the other." As far as he was able to apply the numerous cases, he thought this was an accident.

[Hartley v. Taylor, Settle C.C., Judge Steavenson, 1908, *Policy Holder*, xxvi., 8.]

*Sunstroke*—*Sailor* (W.C.A.).—A sailor was engaged in painting the outside of a ship which was in the tropics. He complained of the heat, and was told to continue working. The accident happened on April 14, and, from the Judge's shorthand note, it appears that the workman fainted, was then taken on deck, vomited, and remained in the sick-bay till the ship got back to Southampton.

Dr. Power, who examined the workman on June 13, found "a very grave injury to the brain, of epileptic form, partial paralysis of the right side of the body, and loss of sensation of the whole of the right side. Slightly feverish, and vomiting at intervals, and by to-day (November 24) he is completely paralyzed and cannot use his limbs. He has acute pains in the head, and shows symptoms of suicidal and homicidal tendency. The paralysis is gradually extending to the other side of the body." He also said: "A seaman painting the outside of a ship is running a greater risk of sunstroke than when employed on deck, because he not only gets the direct rays of the sun, but he also gets the reflected rays from the ship's side."

The sailor had had yellow fever eighteen years ago, and at the age of twelve a fall from the mast. The symptoms, in the opinion of Dr. Power, arose from the sunstroke.

His Honour Judge Gye found that the sunstroke was an accident arising out of and in the course of the employment. The employers appealed.

The Court of Appeal dismissed the appeal.

The Master of the Rolls said that the appeal was quite hopeless. The case was governed by the decision of the House of Lords in *Ismay, Imrie and Co. v. Williamson*, and also by the decision in *Andrew v. Failsworth Industrial Society* (see above, Heat and Electricity).

[Morgan v. Owners of s.s. *Zenaida*, 2 B.W.C.C., 190.]

[NOTE.—Dr. Duncan, who wrote the medical account of Accidents in the Tropics above, has read the Judge's notes of this case, and states: "The symptoms are not those of sunstroke alone; there must have been disease of the brain other than mere sunstroke."]

## TUMOURS.

Tumours are of various kinds; some are of a cancerous nature, and others are not. They are found in the bodies of persons who have sustained a personal injury by accident, and may or may not be



connected with the injury. The cases on tumours are usually classified under the heading of the part of the body in which they are discovered. (*Vide supra*, under the title, Stomach, etc.)

*Tumour* (W.C.A.).—On February 11, 1905, the workman received injuries to his chest, back, and neck. On February 20 symptoms of disease were present, which the arbitrator found was the sole cause of his incapacity to work, and subsequent death on March 26. The injuries, the arbitrator found, resulted in the growth of tumours or swellings on the neck, but the death was due to the disease, which was not caused, or to any appreciable extent accelerated, by the accident. These tumours were lympho-sarcomata.

Held: "On this finding the death was not due to an accident."

[*Cleverley v. The Gas Light and Coke Company*, 1907, 24 T.L.R., 93; 1 B.W.C.C., 82.]

Tumours for which claims are made in connection with injuries may be of various kinds, discussed under Bones, Breast, etc.

*Tumour: Myeloid Sarcoma of the Head of the Humerus—Accident* (W.C.A.).—Arthur Toms, a workman, claimed that a myeloid sarcoma, which necessitated amputation of his shoulder on November 17, 1909, was caused by a sudden backward jerk which his arm sustained on August 30 of the same year.

Toms was employed as a brass finisher, at which employment he had to turn and finish off "lump ends" or rough brass castings used for connection pipes.

While engaged in tightening one of these brass "ends" on the screw of his lathe, a necessary process before commencing to turn, the "end" suddenly slipped off the screw, and, as he was exerting force with a lever to tighten the "end" on the screw, his arm was thrown violently downwards and backwards, straining the shoulder-joint so that he had to leave off work. He went home, and was attended by his own family doctor, Dr. Wilmot, for a swelling of the shoulder-joint.

In September, some month or so after the accident, while being still attended by Dr. Wilmot, Toms went to the Great Northern Hospital, where he was X rayed, and recommended for admission and operation.

The X ray taken at this time was produced in court, and the tumour was apparently of the same size as that shown in the X ray taken at the London Hospital six weeks or so later, and shortly before the operation on November 17; there did not appear to be any signs of increase of the growth in the interval. He went into the London Hospital on November 9, and on the 17th his arm was amputated. Compensation was paid till December 21, 1909.

The applicant admitted that about January of the same year (1909) he had had pain in that shoulder, and that he thought it was rheumatism, and that his wife had rubbed it with some embrocation, but that since then it had given him no pain.

Dr. Wilmot said that the swelling he found after the accident was due to tearing of the muscle fibres of the shoulder, and thought that the strain and inflammation after this started the tumour.

He admitted that the swelling went down gradually, and the tumour was a myeloid sarcoma, which grows from the interior of

the bone (from the bone marrow). He said that, if it was not caused by, then the growth was at least aggravated by, the injury.

Dr. Watts, of 39, Essex Street, Strand, said that the inflammation from the torn muscle fibres on August 30 spread through the bone, and caused the growth in the interior. He had never seen or read of any other case where torn muscle fibres started a myeloid sarcoma, but he thought it had in this case; but he could not say that the tumour arose at the site of the injury. He was not a surgeon, and had never operated upon a sarcoma.

The surgeon who performed the operation at the London Hospital, Mr. Jonathan Hutchinson, F.R.C.S., was in court, as he had been subpoenaed by the workman, but his counsel did not think fit to call him.

The defence was that the tumour was a slow-growing one, and neither caused by nor aggravated to any material extent by the injury; if it were so aggravated, the amount was trivial, and not of any greater degree than that which occurred in *Cleverley v. The Gas Light and Coke Company* (*vide supra*, p. 1075); and, further, that the compensation paid up to December 21 completely covered the amount of incapacity, if any, which resulted from the injury.

Mr. Rock Carling, F.R.C.S., surgeon to Westminster and the Seamen's Hospitals, said he had been on the commission for the causes of cancer. Out of 400 cases of sarcoma of bone that he had examined, and which he collected for that commission, only one had a definite history of accidental injury being the cause, and that case arose in a bone at the actual seat of the fracture. He had frequently to see and operate on cases of sarcoma at Westminster and other hospitals, and had never seen a case arising after rupture of muscle fibres, nor could he see any connection between a strain of this kind and the growth of a myeloid sarcoma *inside* a bone. The two X rays taken, the one within a month of the injury, and the other shortly before the operation, did not appear to show any difference in size; so the growth must, as is usual in that form, have been extremely slow after the injury.

He could not see any sign that the growth of the tumour had been aggravated by the injury, and swellings like this man had, especially after a strain, were common in these growths when they reached the surface of the bone, before which time they might or might not give pain. The pain might be intermittent or continuous. In his opinion it was impossible for this growth to have occurred in consequence of the injury. A myeloid sarcoma was a particularly slow-growing variety of sarcoma, and so little malignant that some of the leading authorities classify it entirely separate from other forms of sarcoma.

Cross-examined: If you had the case of a man who enjoyed excellent health for a period of twenty-one years, who was able to do hard work during the whole of that period, who meets with an accident, and a few months afterwards finds a sarcoma of the bone, is it a violent inference to draw that that sarcoma is due to the accident?

Mr. Carling: Yes, it is very violent. One finds that in a large number of the cases in which people have suffered from tumours that they have never suffered from illness in their lives before. It is a very noticeable fact.

You have expressed the opinion, from the X rays, that this tumour had existed some twelve months before the amputation?—Yes.

Assume that to be correct, when would you expect the person to find pain?—As a rule pain begins when the bone begins to expand, when the tumour has arrived at a size to expand it.

Mr. Jonathan Hutchinson, F.R.C.S., as he was in court, was then called by the respondents. He said that the tumour was, in his opinion, at least a year old, that the injury might have slightly accelerated the growth, but not to any great degree, and in his opinion the operation was inevitable at the time it was performed, whether the accident had happened or not. He did not consider that the date of the operation had been anticipated by the small degree of acceleration of growth in a tumour that was as large as this was within a month of the injury, and which was of this very slow-growing variety, and that there was no evidence in the two X-ray pictures during the interval of time which elapsed between the first picture in September and the second in November.

The following was his honour's reserved and considered judgment :

"Having duly considered the matter submitted to me, I hereby make my award as follows: A medical gentleman sat with me as assessor on August 30, 1909. The applicant while working for the respondents sustained an injury to his right shoulder.

"It was an accident arising out of and in the course of his employment. On November 17 his right arm had to be amputated at the shoulder in consequence of a tumour in the bone.

"His incapacity is due to the loss of his right arm. He received full compensation up to December 20. The question is whether he is entitled to any further compensation. I find that the tumour was in existence at the time of the accident, and that the amputation would have been equally necessary if there had been no accident. I am of opinion that if the accident had in fact affected the source or progress of the disease, it did not necessitate the amputation being made at a date substantially earlier than if there had been no accident. I find that the compensation having been paid up to December 20, no compensation is payable.

[Toms v. Heath, Clerkenwell County Court, May 16, 1910, Judge Bray and a medical assessor. Local papers, May 17, 1910.]

## VESSELS.

### Disease caused by an Accident.

*Aneurism, caused or aggravated by Accident* (W.C.A.). — The deceased man died of heart failure, caused by the backward pressure of a large "fusiform" aneurism of the ascending and transverse aorta—*i.e.*, an even distension of the walls of the largest artery of the body at a spot immediately after it leaves the heart. Its walls were not sacculated or pouched, nor was it a "dissecting" aneurism, in which the blood is forced into the walls of the artery between its various coats. Up till the date of death no one had diagnosed the aneurism. Dr. Dodson, who attended him at the hospital, in

common with Dr. Whitestone, diagnosed rupture of one of the valves of the heart. There was marked atheroma, or disease of the aorta wall, found after death.

The original case, as opened, was that an accident caused an aneurism, but during the proceedings an alternative was set up that the injury might have aggravated an old aneurism, and so accelerated the approach of death.

The history of the case was as follows :

The workman had been a soldier, but for many years had been engaged in heavy labour, chiefly at gas-works. His duties at the time of the accident were mainly night-work. On November 18, 1907, when leaving his work, he stumbled with his left leg into a hole and struck his chest against a gas-nipple projecting from the floor. The bruise was about the size of half a crown, below and just outside the nipple. His doctor said that the ribs and lung were uninjured (which was supported by the post-mortem) and that the bruising did not break the skin. He went home after the injury, and his wife said he stayed in bed most of the day. He then returned to full work for that night, but the next day sent for the doctor, who treated him for contusions of the ribs, and gave a certificate to that effect. No suggestion was made at that date of any injury to the heart.

He remained away from work for three weeks, and then worked continuously for nearly a year, when he broke down, and finally left work in February, 1909. He eventually died in the Oldham Infirmary on June 9, 1909.

His wife and one fellow-workman said that he suffered from breathlessness from the date of his return to work, but the wage-sheets showed full work at full pay for nearly a year after the return to work ; and two of his fellow-workmen said that he did not appear to change at all for many months after his return to work, but that he then became more and more breathless.

Dr. Henderson, the pathologist to the Oldham Infirmary, who did the post-mortem, said that the aneurism was due to old-standing disease and strain, common in soldiers and heavy workers, and was not either caused by or aggravated by the injury. No indications of *specific* trouble were discovered.

His Honour, agreeing with the medical assessor, made an award for the respondents.

[*Hough v. The Middleton Corporation*, Judge Bradbury and Dr. Corns, the medical assessor, Oldham C.C. Local papers, April 21, 1910.]

*Veins : Traumatic Phlebitis* (W.C.A., County Court).—On August 28, 1907, the applicant, in stooping to raise some corn from the ground, "wrung his left leg." Next day this leg swelled ; later inflammation set in, went up to the groin, crossed to the right leg, and went down that leg to the ankle. He was seen by a doctor (Dr. Alexander) the day after the accident, and this is what was evident : "In the left leg the veins were bruised and injured, the muscles were torn, the fibres were ruptured. . . . Afterwards the pain and swelling increased, till the leg was twice its natural size ; the inflammation spread upward along the course of the bloodvessels to the groin, got into

the body, affected the kidneys, attacked the bloodvessels in the other leg, and passed down it. He thinks it was a rare case of 'traumatic phlebitis'—inflammation of the walls of the veins from hurt—and he says the occurrence on August 28 was the cause of all the trouble. Drs. Watson and Cleveland (who did not see Purse till the inflammation had gone) are of opinion that it could not be 'traumatic phlebitis,' and suggest that Purse was suffering from idiopathic or constitutional phlebitis, which suddenly manifested itself on August 29. Then, if Purse suffered from thrombosis, it seems to me inconsistent with what Dr. Alexander observed. The inflammation, as it began to extend up the bruised veins, may have produced sufficient changes to cause the formation of a blood-clot, and thus the inflammation in its abnormal course may have been accompanied and aggravated by thrombosis."

[Purse *v.* Hayward, 1908, 125 L.T.J., 10; 1 B.W.C.C., 216.]

*Varicose Veins* (W.C.A., C.A.).—The applicant claimed that in December, 1907, he was crushed between two railway-carriages, and received severe bruises and contusions. As a result, he said that, in addition to his bruises, varicose veins had set up in his legs, and that the varicose veins were increasing and would get worse.

His Honour Judge Woodfall found that the workman was not incapacitated after October 21, 1908.

[Charing Cross, Euston, and Hampstead Railway Company *v.* Boots, on appeal from Westminster C.C., Judge Woodfall, 25 T.L.R., 683; 2 B.W.C.C., 385; 101 L.T., 53.]

*Varicose Veins* — "Accident." — A workman was injured by a frame falling on his foot in 1904. In 1908 an application was made that the compensation should cease. The medical examination found no trace of an injury, but there were varicose veins. The Judge found that the man was well.

[Beckton Gas Light and Coke Company *v.* Nearne, Woolwich C.C., Judge Willis. Local papers, July 10, 1908.]

### Disease existing before the Accident and aggravating its Effects.

*Aneurism ; Pre-existing Rupture* (W.C.A.).—A workman was tightening a nut with a spanner, pressing down upon the spanner, when a fellow-workman saw his foot apparently slip forward, and he fell back. He tried to recover himself, uttered an exclamation, and fell back again, striking his head. He was then found to be dead. On a post-mortem examination it was found that a large aneurism of the aorta had existed, and death was attributed to the rupture of the aorta. The aneurism was in such an advanced condition that it might have burst while the man was asleep, and a very slight exertion or strain might have caused a rupture.

Held: "The rupture of the aorta aneurism was an accident within the Act."

[Hughes *v.* Clover, Clayton and Co., C.A., Cozens-Hardy, M.R., Farwell and Kennedy, L.J.J., July 22, 1909, 127 L.T.J.; 321.]

Upheld as Clover, Clayton and Hughes by the House of Lords, 3 B.W.C.C., 275.

## WOUNDS.

A few cases, which are not personal injuries, are here quoted to illustrate principles of law discussed in the first few pages at the commencement of this book.

## Insurance.

Death from a wound caused by an accident may be covered by an insurance policy, but this policy also commonly excludes certain forms of death due to the wound becoming infected. These cases are classified under Infection, p. 965. The following is an example :

*Wound : Infection ; Erysipelas ; Septic Pneumonia* (Insurance).—Words of policy : “In case he should be injured by external accidental violence and should die . . . if the injury should be the direct and sole cause of his death. The conditions not to apply to death caused by or arising wholly or in part from any intervening cause.”

Deceased accidentally wounded his leg with his thumb-nail. His leg became inflamed, and erysipelas set in, followed by septicæmia, and finally by septic pneumonia, of which he died.

Held : “That the three complaints above were not intervening causes, but merely different stages in the septic condition causing death, brought about by the poison introduced by the accidental injury.”

WRIGHT, J. : “When once it is agreed that the same instrument inflicted the wound and introduced the poison, it seems to me to follow that the morbid condition of the lungs . . . was directly and solely caused by the wound.”

[*Mardorf v. Accident Insurance Company*, 1903, 1 K.B., 584.]

## Negligence.

**Injury from Things likely to do Mischief**—*Storing of Dangerous Water*.—Rylands wished to have a reservoir for his mill, and to make it, employed competent workmen; when the reservoir had been made and filled up with water it escaped into Mr. Fletcher's mine, which was entered under some disused shafts. Mr. Fletcher sued for the damage done to his mine, but Mr. Rylands said that as he had not been negligent he had on the contrary used all the care he could in building the reservoir and in employing efficient workmen, so he should not be held liable. It was held that negligence was not material as he had collected dangerous forces.

The judgment of Blackburn, J., in this case is given above on p. 4.

[*Rylands v. Fletcher*, 1868; L.R., 1 Ex., 265; L.R., 3 H.L., 330.]

**Monkey Bite**—*Keeping of Dangerous and Ferocious Animal*.—Burdett kept a vicious monkey unconfined, and he well knew that it was of a “mischievous and ferocious nature, and was used and accustomed to bite mankind.”

In consequence of t monkey's behaviour Stephen May and

Sophia his wife brought an action for damages, for that on September 2, 1844, the said monkey "did attack, bite, wound, lacerate, and injure the said Sophia, then and still being the wife of said Stephen May, whereby the said Sophia became and was greatly terrified and alarmed, and became and was sick, sore, lame, and disordered, and so remained and continued for a long time."

The jury gave her £50, and Burdett appealed on the ground that they had not alleged that he had been negligent in not keeping the monkey secured.

This was held not to be necessary.

LORD DENMAN, C.J.: "Whoever keeps an animal accustomed to attack and bite mankind, with knowledge that it is so accustomed, is prima facie liable in an action on the case at the suit of any person attacked and injured by the animal, without any averment of negligence or default in the securing or taking care of it. The gist of the action is the keeping the animal after knowledge of its mischievous propensities. But the conclusion to be drawn from an examination of all the authorities appears to us to be this: that a person keeping a mischievous animal with knowledge of its propensities is bound to keep it secure at his peril, and that, if it does mischief, negligence is presumed, without express averment."

[*May v. Burdett*, 1846, 9 Q.B., 101; 16 L.J., Q.B., 64.]

**Res Ipsa Loquitur.**—The plaintiff, going to the doorway of a house in which the defendant had offices, was pushed out of the way by a servant of the defendant, who was watching a packing-case which belonged to the defendant, and was leaning against the wall of the house. The plaintiff fell, and the packing-case fell on his foot and injured him. There was no evidence as to who placed the packing-case against the wall or what caused its fall. Action brought to recover damages for injuries sustained in consequence of the alleged negligence of the defendant's servant.

Held by BRAMWELL, B., and PIGOTT, B. (MARTIN, B., dissenting): "That there was a prima facie case to go to the jury against the defendant, the fall of the packing-case being some evidence that it had been improperly placed against the wall."

"Packing-cases do not fall naturally and of their own accord when they are carefully placed in a proper position, and we have no right to assume that something was done to this packing-case by somebody else not the defendant's servant so as to cause its fall. Therefore there was a prima facie case of negligence. . . ."—BRAMWELL, B.

[*Briggs v. Oliver*, 1866; 35 L.J., Ex. 163.]

**Res Ipsa Loquitur.**—As the plaintiff was passing along a highway under a railway bridge of the defendants, which was a girder bridge resting on a perpendicular brick wall, with pilasters, a brick fell from the top of one of the piers, on which one of the girders rested, and injured the plaintiff. A train had passed just previously. On examination afterwards, other bricks were found to have fallen out. The bridge had been built and in use three years. . . .

KELLY, C.B.: "The defendants were under the common law liability to keep the bridge in safe condition for the public using the highway to pass under it. . . ."

“The Lord Chief Justice, in his judgment in the court below, said *res ipsa loquitur*, and I cannot do better than refer to that judgment. It appears, without contradiction, that a brick fell out of the pier of the bridge without any assignable cause except the slight vibration caused by a passing train. This, we think, is not only evidence, but conclusive evidence, that it was loose, for otherwise so slight a vibration could not have struck it out of its place. . . .

“The bridge had been built two or three years, and it was the duty of the defendants from time to time to inspect the bridge, and ascertain that the brickwork was in good order and all the bricks well secured.’

[*Kearney v. London and Brighton Railway*, 1871; L.R., 6 Q.B., 759.]

*Res Ipsa Loquitur*.—The plaintiff Byrne was walking along a street in Liverpool, and as he passed the house of the defendant, a flour-dealer, a barrel of flour fell from the upper part of the house and wounded him.

There was no evidence given how the barrel fell, or whether or not it was being lowered; but there was a cart standing opposite the defendant’s premises.

There was no evidence given to show that the defendant or his servants were in charge of or dealing with the flour.

At the close of the plaintiff’s case it was objected that there was no evidence for the jury either to connect the defendant with the occurrence or to prove negligence.

POLLOCK, C.B.: “Mr. Russell was quite right in saying that there are many accidents from which no presumption of negligence would arise; but I think it would be clearly wrong to lay down as a rule that no presumption of negligence can arise from any accident. Suppose in this very case that the barrel had merely rolled out of the warehouse window and fallen upon the plaintiff, how could he possibly ascertain how it occurred? Those who have the care of the barrels should take care that they do not roll out, and I think that is a case where, as it seems to me clear beyond doubt, there would be *prima facie* evidence of negligence. . . .

“So, in the construction or repairing of a house or building, or in putting chimney-pots on the roof of it, if a passenger passing along the road is damaged by something coming down which, according to the ordinary course of doing such work ought not to come down into the street, I think the accident alone would be sufficient negligence. Or, if you set an article that is calculated to do damage altogether in a wrong place, and it does a mischief, then those who are responsible for its being in the right place and under proper control are, I think, *prima facie* responsible for the damage, and the burden is cast upon them showing such a state of circumstances as relieve them from responsibility. . . .”

[*Byrne v. Boadle*, 1864, 33 L.J., Ex. 13.]

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### Ordinary Negligence (Damages).

*Negligence* (C.L.).—The plaintiff, a coal-porter, sued a  
In consequence of negligence, through which his lip and leg were badly



cut. He claimed £50 damages, including three weeks' absence from work. He estimated his wages at £3 10s., and his suit of clothes at £2 3s.

Damages £7.

[*Bray v. Holmes*, Clerkenwell C.C., Judge Bray and a jury. Local papers, July 16, 1908.]

*Damages—Negligence (C.L.)*.—The plaintiff, a ten-year-old lad, was crossing the road, when he was knocked down by the defendant's horse, and his head was badly cut.

Damages £8 2s.

[*Goodhall v. Montague*, Clerkenwell C.C. Local papers, April 16, 1908.]

*Damages—Negligence ; Damages*.—A carman was struck in the face by a piece of timber which the defendant's servant was carrying. His eyebrow was cut and his nose was bruised.

Damages £3.

[*Ringsell v. O'Donnell*, Greenwich C.C., Judge Willis. Local papers, July 24, 1908.]

*Wounds (to Horses) ; Sale of Goods for Specific Purpose ; Latent Defect*.—The plaintiff purchased a carriage-pole off the defendants. It broke and injured the horse and carriage. He sued for damages, including the value of a new pole.

The defence was that the defect was latent.

MELLISH, L.J.: ". . . The governing principle, therefore, is that the thing offered or delivered under a contract of purchase and sale must answer the description of it which is contained in the words in the contract, or which would be so contained if the contract were accurately drawn out. And if that be the governing principle, there is no place in it for the suggested limitation.

"If the article or commodity offered or delivered does not in fact answer the description of it in the contract, it does not do so more or less because the defect in it is patent or latent or discoverable. . . ."

[*Randall v. Newsom*, 1877, 46 L.J., Q.B., 259.]

*Wounds ; Latent Defect ; Railway Passenger*.—The plaintiff was a passenger by the Midland Railway, and was injured in a railway accident through the breaking of the tyre of a carriage-wheel.

LUSH, J.: ". . . The accident arose from the fracture of one of the wheels of the carriage, the tyre of which had split into three pieces, owing, as it was afterwards discovered, to a latent flaw in the welding; and it was proved, on the part of the defendants, that at the commencement of the journey the wheel was to all appearance strong and sound, that such a flaw in the welding may occur without any fault on the part of the manufacturer, that there was no means of detecting it beforehand, and that, in fact, the carriage had been examined, according to ordinary practice, before the train had started on the journey, and had answered to all the usual tests of soundness. . . ."

"It is not contended that the obligation of a carrier of passengers is coextensive with that of a carrier of goods, who by the custom of the realm is placed in the position of an insurer, subject only to the exceptions of loss or damage by 'the act of God, or the public enemies of the Crown' . . . because I can see no reason why a carrier should be held to warrant more than due care and diligence can enable him to perform as respects the quality of his carriage, when it is admitted that he is under no such liability as respects the conduct or management of it. . . .

MELLOR, J.: "My Brother Lush, who presided at the trial, in leaving the case to the jury, told them that a carrier of passengers for hire was bound to use the utmost care, skill, and diligence in everything that concerned the safety of passengers; but that if the injury was due to a hidden defect in the carriage, which the utmost care and skill could not discover, the defendants were not responsible. I have come to the conclusion that such direction was right, and that the rule for a new trial must be discharged. . . .

"The responsibility, both of common carriers of goods for hire and of common carriers for passengers for hire, notwithstanding some important differences between them, rests for its foundation upon the general custom of the realm—in other words, upon the common law—and the liability of each class of carriers, where it is not affected by some special contract, arises from a duty implied by law, although the law will raise a contract as springing from the duty: . . . 'a stage-coach owner, who carries passengers only, is not, properly speaking, a common carrier; he does not warrant the safety of the passengers at all events, but only that, so far as human care and foresight will go, their safe conveyance will be provided for.' . . ."

MONTAGUE SMITH, J.: "This question [of liability] involves the consideration of the true nature of the contract made between a passenger and a general carrier of passengers for hire. It is obvious that for the plaintiff on this state of facts to succeed in this action he must establish either that there is a warranty, by way of insurance on the part of the carrier to convey the passenger safely to his journey's end, or, as the learned counsel mainly insisted, a warranty that the carriage in which he travels shall be in all respects perfect for its purpose, that is to say, free from all defects likely to cause peril, although these defects were such that no skill, care, or foresight could have detected their existence.

"We are of opinion, after consideration of the authorities, that there is no such contract either of general or limited warranty and insurance entered into by the carrier of passengers, and that the contract of such a carrier and the obligation undertaken by him are to take due care (including in that term the use of skill and foresight) to carry a passenger safely.

"It of course follows that the absence of such care—in other words, negligence—would alone be a breach of this contract; and as the facts of this case do not disclose such a breach, and, on the contrary, negative any want of skill, care, or foresight, we think the plaintiff has failed to sustain his action, and that the judgment of the Court below in favour of the defendant ought to be affirmed. . . .

"No case has been found where an absolute warranty of the seaworthiness of the ship in the case of passengers has arisen, and it

affords a strong ground for presuming that no such liability exists, that in this maritime nation no passenger has ever founded an action on it."

[*Readhead v. Midland Railway*, on appeal in the Exchequer Chamber, 1869, L.R., 4 Q.B., 379.]

### Workmen's Compensation Act.

*Bruise—Incapacity* (W.C.A.).—A workman said that some five and a half months before he gave notice of an accident he had suffered from an injury by some coal falling on his shoulder. He saw Dr. Bell immediately after the alleged accident. He did not elect to call him at the hearing of the case. The Judge was not satisfied, and called Dr. Bell himself.

Dr. Bell said: "Applicant came to my surgery about the end of January, complaining of rheumatism. I had on several occasions treated him for rheumatism. He said nothing of an accident, but I noticed an abrasion on the side of his neck, the right side, so slight that I made no note of it. I treated him for rheumatism for some time; after that he came in occasionally to see me, then broke down altogether. He never mentioned the accident to me at any time. The abrasion was on the right side. It was behind the ear, but I am not sure."

After that the applicant went to the Chester Hospital, where he was treated, not for accident, but for rheumatism.

Held: "The employers were prejudiced by want of proper notice."

[*Hughes v. Coed Taton Colliery Company, Ltd.*, 100 L.T., 555; 2 B.W.C.C., 159.]

*Wound of Hand—Claim for Amputation as a Consequence* (W.C.A.).—The Registrar, Bow C.C., refused to register an agreement in full settlement for £3 6s. under the following circumstances:

On July 3 applicant injured his hand with a hook. On August 9 he had a finger amputated at Poplar Hospital. Dr. Humphrey said, in support of his statement, "now the man was practically little better than a one-handed man." Dr. Corder (Dr. Redwood of Poplar Hospital), who amputated the finger, said the injury to that finger was not caused by the accident, but was due to blood-poisoning ten months ago.

His Honour found that £3 6s. was liberal compensation, and that Messrs. Scrutton had acted very straightforwardly in this case.

[*Scrutton v. Merret*, Bow C.C., Judge Smyly. Local papers, October 19, 1907.]

*Animals—Bite of Stable Cat* (W.C.A.).—Cozens Hardy, M.R.: "Part of what may be called the necessary furniture of a stable is a stable cat. . . . The employment of the man took him into the stable, where, to the man's knowledge and to the knowledge of the employer, a cat was habitually kept. If the cat had been a strange cat the case would have presented a totally different aspect."

[*Rowland v. Wright*, 1908, 24 T.L.R., 852; 1 B.W.C.C., 192.]

It is submitted that the case would also have presented a totally different aspect had the bite been occasioned by the man teasing the

animal; for in such a case the accident would not have arisen out of the employment, though it might have been in the course of the employment, but would have been due to the mischievous propensity of the man.

### Defences

**No Negligence.**—The plaintiff went to the defendants' station, intending to travel by train, and made some inquiries respecting the departure of the trains. He was told to go to the time-bill, which was hanging outside of the door of the booking-office and under a covering, or portico. While standing looking at the time-bill a plank and roll of zinc fell through a hole in the roof and injured him; at the same time a man was seen on the roof of the portico.

Held: "That there being nothing to show that the defendants knew that the covering was insecure, or that the man who was upon it was employed by them, there was no evidence of negligence to go to the jury. . . ."

[*Welfare v. The Brighton Railway Company*, 1869; L.R., 4 Q.B., 693, and 38 L.J., Q.B., 241.]

**Contributory Negligence.**—It is no answer to an action for negligence that part of the injurious consequences would not have occurred had the plaintiff not been guilty of some negligence.

The plaintiff, a passenger on board a steamer, was injured in the leg by the falling of its anchor in consequence of a collision with a steamer belonging to the defendant. Case for negligence brought against the owner of the boat with which the boat upon which the plaintiff was a passenger collided. Damages £200.

Held "to be a misdirection to direct the jury that the plaintiff was not entitled to recover if there was negligence in the stowage of the anchor, or in placing himself in the position he did, although the collision occurred from the negligence of the defendant's steamer."

[*Greenland v. Chaplin*, 1850; 19 L.J. Ex., 293.]

**Contributory Negligence.**—The plaintiff was in charge of dynamite cartridges, which he had to fire with a fuse. The method of firing by a torch used on the day in question, with the permission of the foreman, was dangerous; but the plaintiff, as he ran away, carelessly threw away his torch and ignited another torch and fuse.

Held: "The accident was the result of a common fault: that of the defendant in failing to supply a safe means of carrying on dangerous work, and that of the plaintiff by imprudence in negligently using the torch." By the judgment the damages were apportioned, the plaintiff being held responsible for a share thereof, and the defendant condemned in the balance, \$2,000, with costs.

Judgment affirmed by the Supreme Court of Canada.

[*Pacquet v. Dufour*, 1907; 39 Can. S.C., 332.]

### Act of God.

**Act of God; Escape of Stored Water—Negligence.**—On the defendant's land were ornamental pools containing large quantities of water. These pools had been formed by damming up with artificial banks

a natural stream, which rose above the defendant's land and flowed through it, and which was allowed to escape from the pools successively by weirs into its original course. An extraordinary rainfall caused the stream and the water in the pools to swell, so that the artificial banks were carried away by the pressure, and the water in the pools, being thus suddenly let loose, rushed down the course of the stream and injured the plaintiff's adjoining property. The plaintiff, having brought an action against the defendant for damages, the jury found that there was no negligence in the maintenance or construction of the pools, and that the flood was so great that it could not reasonably have been anticipated, though, if it had been anticipated, the effect might have been prevented.

Held: "Affirming the judgment of the Court of Exchequer, that this was in substance a finding that the escape of the water was caused by the act of God, or *vis major*, and that the defendant was not liable for the damage.

[*Rylands v. Fletcher*, L.R., 3 H.L., 330; distinguished.]

MELLISH, L.J.: ". . . The ordinary rule of law is, that when the law creates a duty, and the party is disabled from performing it without any default of his own, by the act of God, or the King's enemies, the law will excuse him; but when a party, by his own contract, creates a duty, he is bound to make it good, notwithstanding any accident by inevitable necessity. We can see no good reason why that rule should not be applied to the case before us. The duty of keeping the water in and preventing its escape is a duty imposed by the law, and not one created by contract. If, indeed, the making of a reservoir was a wrongful act in itself, it might be right to hold that a person could not escape from the consequences of his own wrongful act; but it seems to us absurd to hold that the making or the keeping a reservoir is a wrongful act in itself. The wrongful act is not the making or, keeping the reservoir, but the allowing or causing the water to escape. . . . But the present case is distinguished from that of *Rylands and Fletcher* in this, that it is not the act of the defendant in keeping this reservoir, an act in itself lawful, which alone leads to the escape of the water, and so renders wrongful that which, but for such escape, would have been lawful. It is the supervening *vis major* of the water caused by the flood, which, superadded to the water in the reservoir (which of itself would have been innocuous), causes the disaster. A defendant cannot, in our opinion, be properly said to have caused or allowed the water to escape if the act of God or the Queen's enemies was the real cause of its escaping without any fault on the part of the defendant. . . .

"We are of opinion, therefore, that the defendant was entitled to excuse herself by proving that the water escaped through the act of God.

". . . But we think that she ought not to be held liable because she did not prevent the effect of an extraordinary act of Nature, which she could not anticipate. . . . It was, indeed, ingenuously argued for the appellant that at any rate the escape of the water was not owing solely to the act of God, because the weight of the water originally in the reservoirs must have contributed to break down the dams, as well as the extraordinary water brought in by

the flood. We think, however, that the extraordinary quantity of water brought in by the flood is, in point of law, the sole proximate cause of the escape of the water. It is the last drop which makes the cup overflow.

“On the whole, we are of opinion that the judgment of the Court of Exchequer ought to be affirmed.”

[*Nichols v. Marsland*, 1876, L.R., 2 Ex. D., 1.]

### Not the Natural and Probable Consequences.

*Natural and Probable Consequence.*—The plaintiff employed the defendant to remove her goods in his cart for hire. With the consent of the defendant's carman, the plaintiff got on the cart with the goods, and when she was on the cart it broke down, and the plaintiff was seriously injured and her goods broken. Action for negligence.

Injury: Leg broken, and plaintiff otherwise bruised and injured.

Held: “That the plaintiff was not entitled to recover damages for the personal injury.”

[*Lygo v. Newbold*, 1854, 23 L.J., Ex., 108, and 9 Ex., 302.]

### X RAYS.

The editor has not yet discovered any case where injuries due to X rays have been the subject of litigation, but under the section on electricity will be found one of an electric burn.

## APPENDIX

SCHEDULE III. OF THE WORKMEN'S COMPENSATION ACT,  
1906, WITH THE ADDITIONS AND CHANGES MADE  
THERE TO BY THE SECRETARY OF STATE ON  
MAY 22, 1907, AND DECEMBER 2, 1908.

Description of Disease or Injury.	Description of Process.
Aniline, <i>see below</i> , Nitro-benzine.	
Ankylostomiasis.	Mining.
Anthrax.	Handling of wool, hair, bristles, hides, and skins.
Arsenic-poisoning or its sequelæ.	Handling of arsenic or its preparations or compounds.
Beat elbow, acute bursitis over the elbow (miners').	Mining.
Beat hand, subcutaneous cellulitis of the hand.	Mining.
Beat knee, subcutaneous cellulitis over the patella.	Mining.
Caisson disease, compressed air illness or its sequelæ.	Any process carried on in compressed air.
Carbon bisulphide, poisoning by, or its sequelæ.	Any process involving the use of carbon bisulphide or its preparations or compounds.
Chimney-sweeps' cancer (scrotal epithelioma).	Chimney-sweeping.
Chrome ulceration or its sequelæ.	Any process involving the use of chromic acid or bichromate of ammonium, potassium, or sodium, or their preparations.
Dust or liquids, eczematous ulceration of the skin produced by, or ulceration of the mucous membrane of the nose or mouth produced by dust.	
Glanders.	Care of any equine animal suffering from glanders; handling the carcase of such animal.

Description of Disease or Injury.	Description of Process.
Glassworkers' cataract.*	Processes in the manufacture of glass involving exposure to the glare of molten glass.
<i>Gonioma Kamassi</i> (African boxwood), poisoning by, or its sequelæ.	Any process in the manufacture of articles from <i>Gonioma Kamassi</i> (African boxwood).
Lead-poisoning or its sequelæ.†	Handling of lead or its preparations or compounds.
Liquids, <i>see above</i> , Dust.	
Mercury-poisoning or its sequelæ.	Any process involving the use of mercury or its preparations or compounds.
Miner's wrist, inflammation of the synovial lining of the wrist joint and tendon sheaths.	Mining.
Nickel carbonyl, poisoning by, or its sequelæ.	Any process in which nickel carbonyl gas is evolved.
Nitro- and amido-derivatives of benzine (dinitro-benzol, anilin, and others), poisoning by, or its sequelæ.	Any process involving the use of a nitro- or amido-derivative of benzine or its preparations or compounds.
Nitrous fumes, poisoning by, or its sequelæ.	Any process in which nitrous fumes are evolved.
Nystagmus.	Mining.
Phosphorus-poisoning or its sequelæ.	Any process involving the use of phosphorus or its preparations or compounds.
Pitch, tar, or the tarry compounds, epitheliomatous cancer or ulceration of the skin or of the corneal surface of the eye due to.	Handling or use of pitch, tar; or tarry compounds.
Tar, <i>see above</i> , Pitch.	
Telegraphists' cramp.	Use of telegraphic instruments.

\* "A glass-worker suffering from cataract shall be entitled to compensation under the provisions of the said section, as applied by this order, for a period not longer than six months in all, nor for more than four months unless he has undergone an operation for cataract."

† "Where regulations or special rules made under any Act of Parliament for the protection of persons employed in any industry against the risk of contracting lead-poisoning require some or all of the persons employed in certain processes specified in the regulations or special rules to be periodically examined by a certifying or other surgeon, then, in the application of this schedule to that industry, the expression 'process' shall, unless the Secretary of State otherwise directs, include only the processes so specified."

N.B.—The above is arranged in alphabetical order, and slightly redrafted for convenience of the purposes of reference. For quotation in Court the exact words of the Act must be employed.



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[The law of negligence is fully treated in Part I. at pp. 1-32. At pp. 863 *et seq.*, in the Case Guide, a group of cases under the head of Negligence is placed, as far as possible, in every section, the two main points especially considered being the amount of damage and the duration of incapacity.]

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## R

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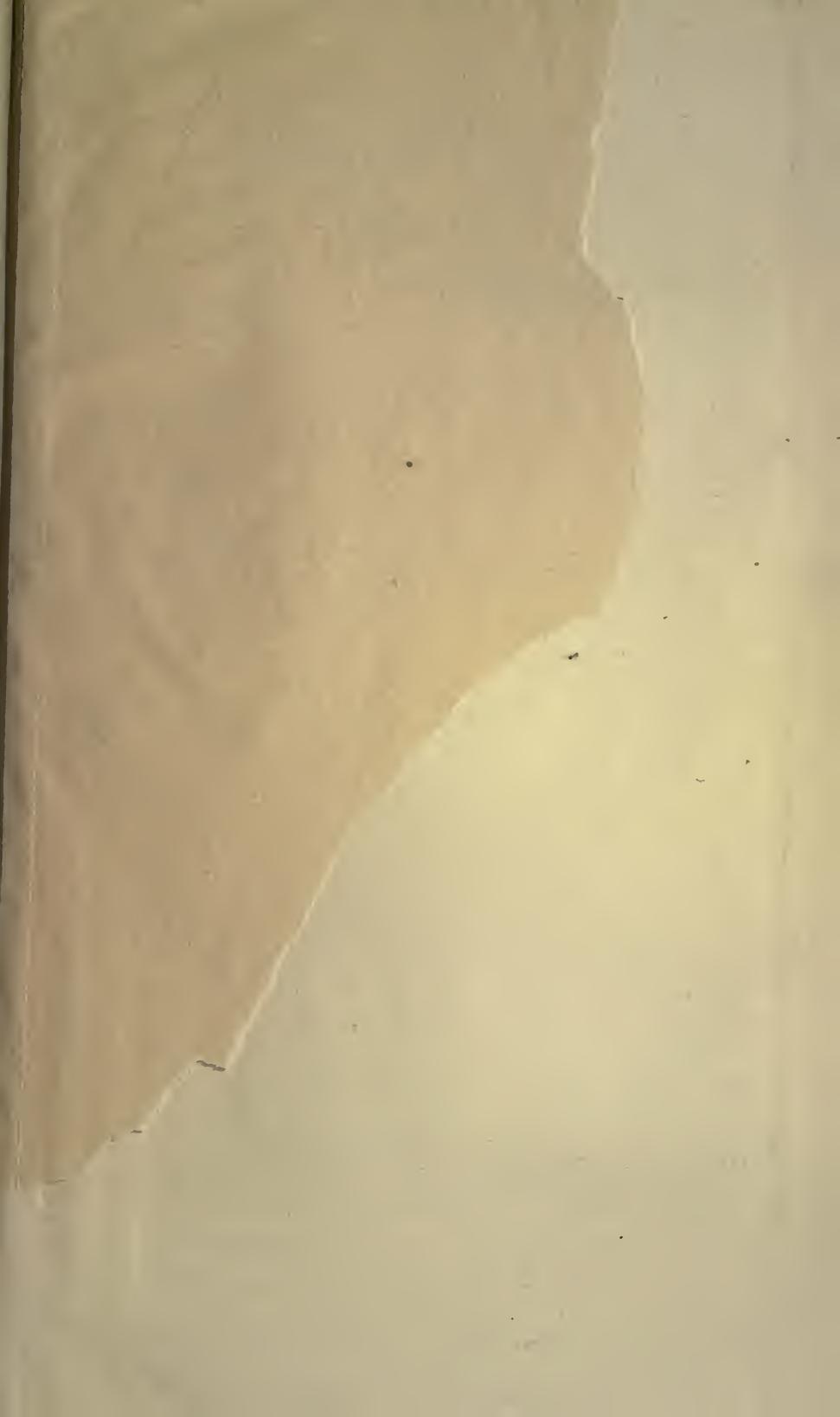
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