Sanitation-Disinfection

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SANITATION AND DISINFECTION

A CONCISE TREATISE ON DISEASE PREVENTION WITH SPECIAL REFERENCE TO THE COMMUNICABLE DISEASES

BY

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"CHEMISTRY OF EMBALMING"

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DEDICATION

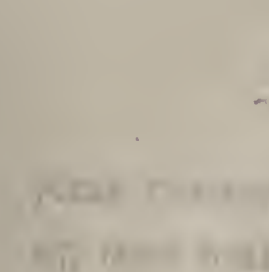
To the memory of my father whose life was devoted to helping the hurt of the world this volume is respectfully dedicated.

Preface

IN presenting this work the chief purpose has been to amass in concise form the essentials of disease prevention as it relates to the communicable diseases, including the fundamental principles and facts on which such prophylaxis depends. In its preparation the writings of numerous authorities have been consulted, including Green, Holt, Smith, Nuttall, Osler, Abbott, Welch, Sternberg, et al., and to these gentlemen an acknowledgement is hereby made.

In the consideration of special diseases an attempt has been made to record in an easily accessible form the many little matters of detail so essential and yet so easily forgotten. The symptomatology, except in so far as it is diagnostic, and the treatment of these affections, have been omitted believing this phase of the communicable diseases belongs rather to the practice of medicine than to sanitation. It is hoped the matter may be found a practical working guide to all who may be called upon to deal with the problems considered.

Charles N. Culley



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CHAPTER I.

The Causation of Disease.

The causation of disease has from an early period of the world's history been the subject of much theorization and conjecture. What appeared to be the solution to the problem would be given out by some reasoner and for years his theory would be accepted as the correct one. Man, however, has an investigative turn of mind and ever seeks to establish new truths or disprove old theories, and naturally as the years have gone by solution after solution to the perplexing problem has been offered until at the present time we have almost as many theories as scientists, each presenting arguments, each possessing facts, each numbering its champions and antagonists and each worthy of consideration.

Operating on the animal economy are the vital force and the chemical force. These forces are quite separate and distinct, even antagonizing each other. The vital force is that power which from a single cell builds up the entire organism, appropriates from nutritious material furnished it the portions necessary to secretion, excretion and innervation, supplies the waste of

tissues and tends to keep the body intact resisting all disintegrating influences. By chemical force is understood the antithesis of the above; the cause of waste of the body, disintegration of tissue, change of matter from a higher to a lower grade of organization and all the retrograde tendencies of the body from a state of health, through disease, death and decomposition. Life is a forced state of being caused by an ascending of vital over chemical force. Health, the exercise of function pleasurably or unconsciously, consists in the maintenance of the proper equilibrium between the two and disease is the result of the ascendency of the chemical over the vital force in some organ or tissue.

This vital force is man's direct inheritance from a spiritual creator or origin and has existed from all time. The chemical force was not known until after the curse which was pronounced on our progenitor and through him on all mankind. With this curse was the advent of disease, death and decay, and reasoning from this fact there are those who regard sin as the direct cause of all disease. These reasoners regard every manifestation of disease or injury as a direct evidence of some deviation from the law of God and speak of the affliction as being punishment for disobedience. The position is not wholly without argument since the laws of God are directly inductive to perfect health and long life if religiously observed, and since any departure from many of these laws—as for example the law of temperance in all things—is directly followed by the manifestation of disease and suffering in such a manner that the relation can not but be observed. Closely related to this class are those who regard disease as the possession of an evil spirit.

The mythology of the ancients furnishes another theory of the causation of disease, somewhat analogous to the above. A box with cunning and intricate fastening was conveyed to earth by Mercury and left for a time in the care of Pandora—woman—who priding herself on her skill and deftness of fingers impatiently applied herself to the task of opening the casket. She was soon rewarded, the box opening and releasing myriads of small insects which at once began to bite and sting mankind until the cure had been released from a smaller box confined within the larger. The box had been sent to earth as a punishment for man's having accepted the gift of fire from Prometheus, who had stolen it from the gods on Mt. Olympus. The insects were interpreted by the ancients as being disease, cold, hunger, etc., and the cure as Hope. Acting on this theory worshipers of these gods attributed each departure from healthy function to anger of the gods and by sacrifices to these gods sought to avoid disease and to cure when attacked.

According to the chemist there are some sixty-five primary forms of matter or elements and from these sixty-five elements all things are compounded. At one time this number was placed very much higher but on subsequent analysis some substances thought to be elements were proven to be compounds. There are many who believe numbers of the so-called elements of today will yet be decomposed into simpler forms of matter and there are some who go even so far as to say that all forms of matter will be resolved into modifications of force, and that strictly speaking we have no matter as the term is understood usually. This furnishes a basis for a class whose number is not small who reason that dis-

ease is purely a mental state, an imaginary state of being if you please. Their reasoning is that an organ or tissue can not be affected by any disease or substance for the simple reason one has no organ or tissue to be affected and there is no such thing as substance to produce an effect. The cure or prevention of all abnormal states with the class resolves itself into a simple belief or "faith" that one has no affection or organ to be affected and that he is quite well and comfortable.

Another class with a considerable following are those who estimate all change of function or structure by the measure of excess, defect or perversion. This rule may be employed either in the estimation of cause or the estimation of process. For example, in simple indigestion or dyspepsia the affection may have been induced by an excessive amount of food, a deficient amount or a wrong kind — a perverted quality. Again this measure may be made to estimate the nature of the abnormal conditions in that there may be an excessive muscular action of the stomach and intestines, a deficient action of the same or a reversed peristalsis (perverted action) inducing vomiting, etc. This theory may be applied to the secretions of the stomach in consideration of this same disorder. In the same manner it is applied to other disease conditions.

We have in the germ theory the latest ideas of scientific investigators on the causation of disease. Tersely put it is that certain disease processes are due to the invasion of the system by certain micro-organisms or their toxines. These micro-organisms, commonly known as bacteria or germs, are parasitic and vegetable in character and are in no manner related to the animal parasites. In other words they are not "bugs" as so

commonly called, but minute vegetable growths belonging to the class fungi.

In 1675 Leeuwenhoek, a linen draper of Amsterdam, perfected a lens by means of which he could see in a drop of rain water the bodies now recognized as bacteria. The development of the germ theory of disease covers a period from that time up to the present. In 1840 Henle clearly formulated the theory that living organisms were the cause of certain diseases. The similarity of process between the infectious diseases and fermentation (the cause of which had been more thoroughly investigated and shown to be a micro-organism) led to investigation of these diseases with the view of finding similar causes. The similarity was marked. Infection corresponded to the addition of ferment, incubation was analogous to a period of inactivity. The fever, outbreak and course of disease corresponded very closely to a rise of temperature and active fermentation; the decline of disease processes to a gradual cessation of fermentative processes and the subsequent immunity to the period during which the addition of more ferment was followed by no activity. Dr. Henry Green has arranged these similarities very logically in parallel columns.

It is still a mooted question just how micro-organisms operate to induce pathological conditions. A mechanical plugging of the capillaries by the presence of bacteria in the blood has been suggested as the solution but this hypothesis will not bear investigation for in certain affections known to be of bacterial origin, diphtheria for example, the blood seems to be entirely free from the presence of these organisms. The most reasonable solution that has yet been offered is that

the disturb of functions is due to the presence of certain toxines or poisons produced by the micro-organisms. The argument of these various hypotheses is too voluminous to permit being mentioned, but may be found in almost any standard work on bacteriology.

The various tests in the proof that any specific disease is due to any definite germ may be stated briefly. First the germ must be shown to be always present in that disease, though the mere presence does not indicate that it causes the disease. Second, the germ must be artificially cultivated (reared on some medium outside the animal) and a pure culture (one that contains no other organism) obtained. Third, this culture must be used to inoculate a subject and when so used must produce the disease. Fourth, in analyzing this new artificially produced disease it must be found that this germ has multiplied in this new host. Fifth, all of the above steps must be repeated to prove the theory. Sixth, the accidental presence of the germ in other diseases or in health does not disprove the theory.

This germ theory is not applicable to all forms of disease, but only to the infectious diseases. The effect of its proof is immeasurable in the revolution of treatment and the means of prophylaxis.

CHAPTER II.

Bacteria.

Strictly speaking the term bacteria, or schizomycetes, includes but one of the three great divisions of thallophytes, parasitic fungi, or vegetable organisms demonstrated to be related to the diseases of the human family, the other two classes being the yeasts or blastomycetes and the moulds or hyphomycetes. The bacteria are the most important of the three since they produce nearly all the infectious diseases, putrefaction and several of the ferments. In common parlance, however, the term bacteria has come to be applied to all three forms or classes of parasitic fungi, parasitic here being employed in its broader sense including hosts of dead organic matter as well as living. These organisms are one-celled plants in which there is no distinction between leaf and stem and are with few exceptions characterized

Figure I.
Cocci.

Figure II.
"a" Slender bacilli.
"b" Short heavy bacilli.
"c" Bacilli in chains.

by an absence of chlorophyl, the green coloring matter of plants. These organisms are of microscopic proportions, being from 1-400 to 1-20000 of

an inch in diameter, but are known to be vegetable in character and not animal by certain microscopic and chemical differences. The cell contents of bacteria is a mass of protoplasm more or less homogeneous. There is a cell membrane closely allied to gelatine and which markedly resembles cellulose, a substance composed of carbon, oxygen and hydrogen and of the nature of starch. This cell membrane which under ordinary conditions the microscope fails to reveal becomes visible during sporulation and when treated with certain chemical substances is shown to be surrounded by a gelatinous layer. The membrane is elastic.

The terms germ, microbe, bacterium and microorganism, which are applied interchangeably in speaking of these bodies are in a general sense synonymous but in their restricted application differ somewhat. Webster has defined a germ as "that which is to develop an embryo; that from which anything springs; a point of growth; origin." From this definition it may be readily

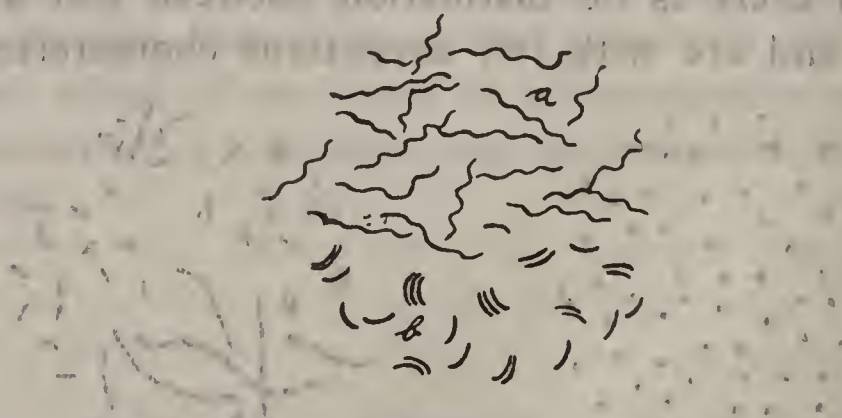


Figure III.
Spirilla.
"a" Spirochaeta.
"b" Comma bacilli.

seen the term applies equally as well to the life-giving principle of a grain of wheat or corn, to the primary element of animal life or to the starting point of some public movement, as for in-

stance a political revolution, as it does to these minute organisms under consideration. Microbe is really a contraction from the word micro-bacterium which constitutes one class of bacteria which in itself is only one of three great classes of parasitic fungi. In this sense the microbes or micro-bacteria include but a very small percentage of these vegetations and are of no practical interest to the pathologist since no member of the class is in any instance disease producing in man. In the restricted sense bacteria or fission fungi have already received mention in contradistinction to the yeasts and moulds. Among other differences the bacteria grow by fission (transverse divison), the yeasts by gemmation (budding) and the moulds by means of an apical cell which elongates and divides somewhat after the manner of the bacteria. Vegetable parasite is a term which includes many structures not microscopic and aside from their parasitic and vegetable character in no manner allied to the organisms which have been demonstrated to bear a relation to the diseases of man. Micro-organism includes all of the above classes, and is to my mind much the best term, but is open to the objection of being somewhat indefinite. As stated above though these appellations have come to be used interchangeably and may in all propriety be regarded as synonymous except where the restricted sense is called for by the context.

Three factors enter into the influence tending to our present status of knowledge relative to bacteria, viz: improved microscope, improved methods of culture and improved methods of staining. One has but to compare the simple imperfect lens with which in 1675 Leeuwenhoek discovered the animalcules, with the highly fin-

ished product of modern times, quite free from aberrations of form or color and practically unlimited in magnifying power, to realize what a

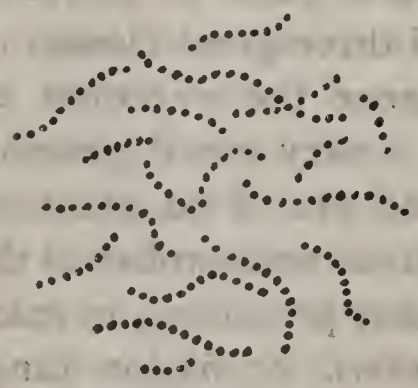


Figure IV.
Streptococci.

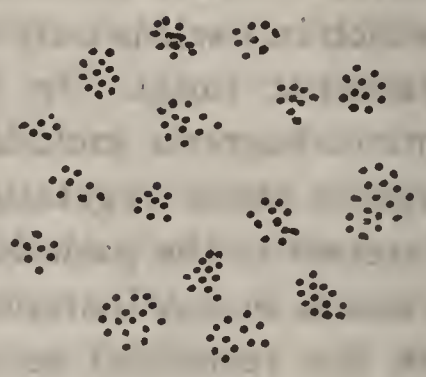


Figure V.
Staphylococci.

potent factor this improvement has been in recognizing and classifying the numerous forms of bacteria which today we not only recognize but isolate and grow with as much certainty of pure cultures as the farmer who is careful to put in the soil choice seed of a selected variety, and even more certainly since we can remove from the soil (culture medium) all other seeds (germs), a thing the agriculturalist can not perform. The earlier work of bacteriologists did not include efforts at culture. Later, organisms were grown in various media, fluid and semifluid, gradually the improved methods of culture reaching the plane of solid media on which we stand today. The results are obvious. Isolation of growths can be made that in the earlier days was quite impossible. These increased facilities of growth and examination resulted in the knowledge that these organisms were of differing resistence to external influences, and that they differed in this respect from the tissues and fluids in which they were found and from spore forms. Reasoning from these facts soon developed vastly improved methods of staining these organisms so that their

presence might the more easily be detected. To repeat, these three factors have been the means

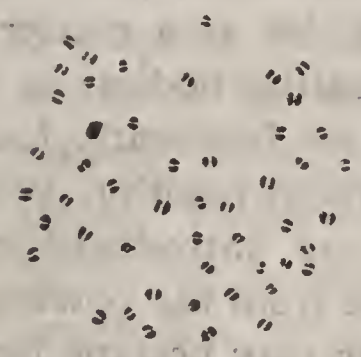


Figure VI.
Diplococci.

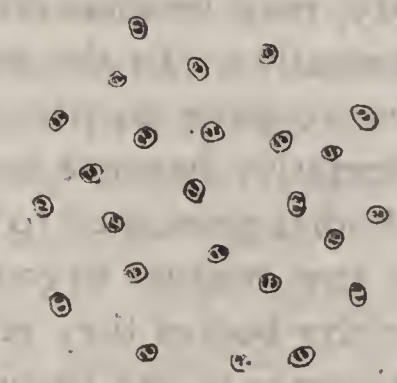


Figure VII.
Diplococci encapsulated.

of the more perfect science of bacteriology we enjoy today.

With the exception of where life is not at all possible bacteria are found on all exposed surfaces. This statement includes surfaces both directly and indirectly exposed and hence the alimentary tract of man. Indeed the human body seems to be fairly alive with them the points most freely inhabited being the axilla, under and around the nails, between the toes and in the mouth. The genitalia are likewise freely infested. For reasons which will appear later certain portions of the alimentary canal are freer from bacterial life than others, the stomach for instance being perhaps the most free and the mouth probably containing the greatest numbers and variety for obvious reasons. The abdomen is one of the first parts of the human body to present marked putrefactive change owing to this presence of bacteria in the intestinal canal and the excellent conditions for their growth and multiplication. True the abdominal organs of digestion are preceded in the changes of decomposition by the mucous lining of the larynx and trachea, which is also freely exposed to bacterial influence, but the first

changes of marked character are abdominal. The question, do bacteria exist in the perfectly healthy body, may be answered in both the negative and affirmative. In the negative, for as a matter of fact we have no perfectly healthy bodies; in the affirmative because bacteria are frequently found in bodies presumed to be perfectly healthy. When by any means organisms are introduced into healthy bodies they either die from the powers of resistence of the body or they may become localized and set up a disease process or be walled up somewhat after the manner of foreign bodies that are shut off that they may occasion no harm. When they remain in the body in a quiescent state they are very properly spoken of as latent bacteria.

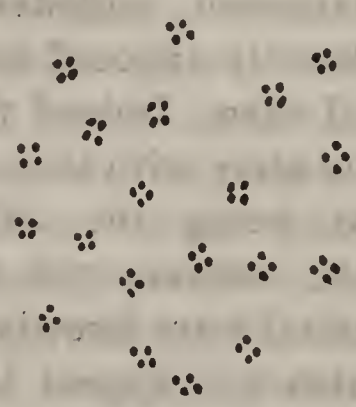


Figure VIII.
Tetracocci.

The ultimate disposal of bacteria in the animal body is in a variety of ways. In the destruction of tissue that frequently follows bacterial invasion, these organisms are thrown off in large numbers by a process of sloughing, the pus and sloughs often containing numerous organisms not necessarily connected with suppurative processes. The excreta furnish an avenue for escape for numerous forms of bacteria the feces being the most abundantly laden. In health the urine is almost free from these growths but in disease,

particularly in diseases of the bladder, some forms of kidney affections and in certain other disturbances of the genito-urinary tract it is freely infected. Some of the organisms which gain access to the system are thrown off as waste material having died from various causes. The various forces which occasion death in these germs are a lack of proper food, contact with germicides, or a sort of autointoxication from their function of toxic secretion, throwing off substances directly poisonous to themselves, namely, indol, scatol and phenol. The remainder are cared for by the phagocytes which constitute a very considerable percentage of the leucocytes or white blood corpuscles.

Motion of two or three forms is ascribed to micro-organisms. First is a quivering resembling that of a form or mold of jelly. This is known as molecular or Brownian movement. In addition to this some forms have a wavy or corkscrew-like movement while some possess genuine locomotion. This latter motion is due to the presence of certain hair-like or filiform processes known as flagella. These processes may be given off from either or both ends of the organism or from any part of its surface and may either be one or many.

These plants possess certain requirements for their growth and activity. Among these requirements may be mentioned moisture, a suitable temperature and proper food. All forms of bacteria require a certain amount of moisture to maintain an active existence, but while most bacteria are quite destroyed by depriving them of water some withstand this deprivation to a very considerable degree and a few remain potent,

though inactive, after practically all moisture has been extracted. To this latter class belong the bacilli of tuberculosis and it is with this fact in view that the various State Health Boards are warring against the spitting on streets and floors of public buildings and carriers, knowing the tubercular sputum so often expectorated (one mouthful sometimes containing as many as four billion germs) is too frequently carried in the form of dust to the air passages of a new host where it lights up the disease processes and after furnishing a like means of infection to hundreds of others goes on indefinitely and unresisted claiming its thousands of victims annually. Bac-

Figure IX.
Bacilli showing spores.

teria can not maintain an active existence in a temperature over 60 degrees C. or under 0. These limitations are, however, only reached by a few organisms most not reaching these extremes by from five to fifteen degrees. Disease producing bacteria flourish best in a temperature about equal to that of the human body, i. e., 37.5 degrees C. (98.6 degrees F). The effect of excessive cold and heat — freezing, boiling, steamheat, etc.—is best considered in connection with disinfection. The food supply of bacteria necessarily contains hydrogen, potassium, nitrogen, carbon, phosphorus, magnesium, sulphur and some other constituents, and being achloriferous plants they re-

quire that their food shall be presented in the form of decomposable organic matter either living or dead since all achloriferous plants lack the power to appropriate inorganic substances. A further essential feature of bacterial life and activity is the reaction of the media which with

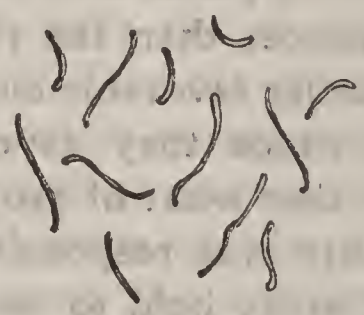


Figure X.
Vibrios.

but few exceptions must be either neutral or slightly alkaline.

Many chemical substances influence germ life; some through their acidity or alkalinity, some through a corrosive power and some through their power to coagulate albumen thereby not only destroying the germ but also the germ food. Electrical currents also effect the activity of these organisms and light exercises a powerful influence even as it does over the higher forms of vegetable life. The direct sun rays destroy certain forms of bacteria but these points like excessive heat and cold are more properly discussed under the caption, Disinfection.

Parasitic fungi multiply by fission, by sporulation, by gemmation or the division of an apical cell. The first form applies more particularly to the bacteria—bacteria here being used in the restricted sense. The yeasts muliply by gemmation and the moulds by the apicial cell. All forms sporulate but the principal function of sporulation is preservation of kind rather than reproduc-

tion though all forms do so multiply. By spore is meant an immature form so to speak. Indeed there seems to be a close analogy between seeds and spores. Both present a greater density than the fully developed active plant; both are more highly refractive than the plant itself; both grow at the expense of the plant; both are less sensitive to external influences than the plant; and both will reproduce under favorable circumstances the organism from which they developed. It was formerly taught that want of proper food supply or lowered vitality was responsible for sporulation and indeed many hold to this theory at the present. On the other hand high authority states that sporulation occurs when bacterial activity is at the highest and when the conditions of growth are the most favorable, so that just why one cell will produce a new cell and another a spore is impossible to say. Spores are of two kinds or

Figure XI.
Micro-organisms showing flagella.

classes, endospores and arthrospores. The first are produced within cells. The latter are never within the cells, but certain cells possess certain peculiarities that entitle them to be classed spores. It may be stated as a rule that one spore is the entire production of one cell.

On basis of hosts, requirements, form, etc., bacteria are divided into many classes. On basis of

requirements there are the aerobics or those which can not thrive save in the presence of oxygen, the anaerobics or those which can only exist in the absence of oxygen and the facultative which can accommodate themselves to either condition. Parasitic bacteria are those which require a living host whilst saprophytic require a dead host and again we have the facultative which flourish in either. There are three classes on basis of form, the round or micrococci, the rod or bacilli, and the spiral or spirilla. Of the round forms or micrococci there are the megacocci or large round organisms; the diplococci or those found in pairs; the tetracocci found in fours; the sarcinae found in eights; the streptococci found like strings of beads and the staphylococci found in groups like a bunch of grapes. Of the spiral forms there are the spirochaeta which are thread-like organisms in a wavy line; the spirolina, a thread-like organism, looped; the vibria, a bent rod; and involution forms i. e., odd shapes. As to products or properties there are among other classes chromogenic or color producing, zymogenic or ferment producing, saprogenic or putrefactive and pathogenic or disease producing. The above are but a few of the many classes of bacteria that have been introduced into the literature of the subject, many being used by different authors in different senses, so that the nomenclature of bacteriology is not only perplexing to the average student but even confusing to the specialist.

CHAPTER III.

Antiseptics.

There is a marked and almost irresistible tendency for all organized bodies to become reduced from the more complex to the more simple states until the ultimate in elemental structure is reached. All organized bodies, in other words, tend toward decomposition or to become what is commonly designated rotten. These changes have been referred to variously as fermentation, rotting, decomposition, spoiling, disintegration, putrefaction, sepsis, etc., etc. During the several successive changes which intervene between the very complex structure in the beginning and the simple ultimate derivatives numerous products are formed which act in various ways. Some are characterized by malodorous properties; others cause to become unsightly that which is desired to remain fair to look upon; others are hazardous to the public health either when inhaled or when taken into the alimentary tract in the form of fermenting or decomposing food or drink. In view of the above offensive properties of sepsis or putrefaction, it is not strange that scientists should have sought out the cause of the destructive processes, or that a number of agents have been brought out to oppose these processes of disintegration. Such agents are known as antiseptics — meaning literally opposed to or against sepsis. In order to appreciate the full significance of the term and its usual applica-

tion, it is necessary to recall the cause of sepsis or putrefaction namely, the micro-organism. Briefly stated antiseptics are those agents which prevent the growth and activity of bacteria, not necessarily destroying them as do the disinfectants which are germicides and which will be considered later. From the above it will appear that disinfectants are essentially antiseptics but that an antiseptic need not necessarily be a disinfectant. As a matter of fact, however, most antiseptics differ from disinfectants only in degree of application or of concentration and become disinfectants when more thoroughly applied or more thoroughly concentrated.

The effect of antiseptics being to render living organisms inoperative, this result must be brought about either by destruction of the living organism (though this action is only induced by a disinfectant) by a perversion of its food supply so that the organism is ineffective through deficient nourishment, by a reduction or elevation of temperature below or above which they may not remain active, or by changing the media in which they are found until it is no longer habitable. The food of micro-organisms must be in the form of soluble (destructible) compounds and that which tends to harden or render less destructible those compounds naturally destroys bacterial food and is an antiseptic just in the degree it possesses the power. Much of the food of these organisms being albumen or albuminoids, which they render liquid it is obvious that any chemical that will harden albumen or albuminoids or that tends to render them insoluble acts as an antiseptic as has been stated above just in the degree it possesses this power and of a very large percentage of antiseptics it may be said,

they coagulate albumen. The extremes of temperature between which these organisms retain their power of activity have been mentioned above (see page 28) and need not be repeated. The process of preserving foods by means of elevated temperatures involves the principles of sterilization — destroying germ life present — and then excluding the sterilized articles from further contamination with germ life. This process is sometimes a failure simply from the fact the temperature has not been sufficient to destroy all bacteria and all spores or the sealing has been imperfect. Fractional or intermittant sterilization overcomes this difficulty. Cold storage preservation depends on the principle that below a given temperature bacteria are ineffective. In the matter of media any thing that will give to the media an acid reaction or more than a slightly alkaline reaction to litmus renders, with but few exceptions, the organisms in that medium inoperative and is an antiseptic in that proportion. For this reason a sour lemonade is better for drinking purposes than a suspected water even though the lemonade may be made of the suspected water. Nearly all antiseptics depend on one or more of the above principles for their power.

In speaking of antiseptics it is usual to ascribe to them a definite degree or power of antisepsis which is usually expressed in the form of a ratio as, 1:725 or 1:19. The full significance of this expression may not be perfectly clear to some and is best illustrated by a full description of how the antiseptic power of any chemical is determined, a ratio power being usually applied to chemical antiseptics. To a test tube containing a known amount of sterile medium a definite amount of

the chemical to be tested is added and the tube is then inoculated with the organism with which the tests are to be made. If at the end of a definite number of hours, usually twenty-four, no growth appears, another test is then made with a less amount of the chemical and the process repeated until a point is found just below which the micro-organisms will increase in numbers and remain active. The proportion of the chem-

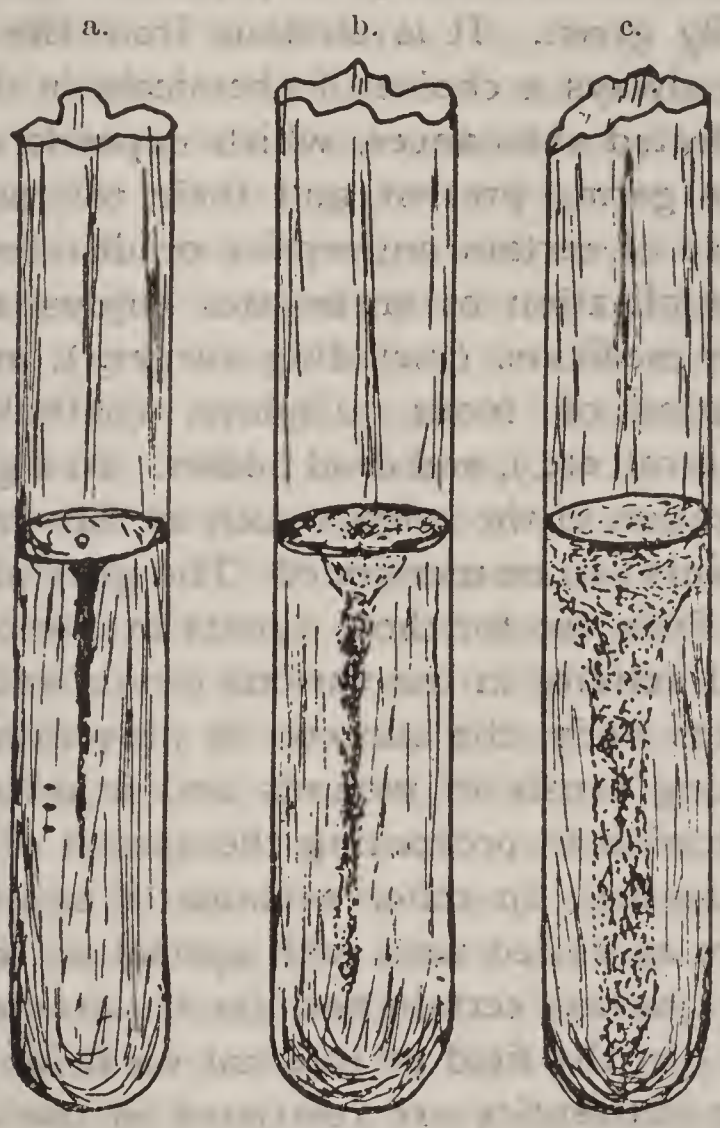


Figure XII.

Culture tubes showing rapid growth of bacteria. "a" 36 hours, "b" 60 hours, "c" 84 hours.

ical to the medium at this point represents the antiseptic value or power of the chemical. Usually for sake of comparison a control tube is kept along side the tube in which the test is being made. This control tube is exactly similar to the other in all particulars save that the chemical

is omitted. The amount of medium is the same and the germs with which it is inoculated are the same. In all cases of course the control tube should show growth. Since the power of resistance to chemical antisepsis differs in the various micro-organisms the antiseptic value of a chemical varies, depending on the germ with which it is tested. However, only one, the average power is usually given. It is obvious from the above there is always a choice of chemicals in dealing with infected substances, which depends on the germ or germs present and their tolerance or resistance of certain antiseptics or disinfectants.

The application of antiseptics enjoys a wide range in medicine, (including surgery), and the preservation of foods, displays, (pathological, horticultural, etc.), and dead bodies. In a general consideration of the subject such as this only the chief points can be mentioned. The general practitioner finds use for these agents in overcoming bacterial activity in the various canals and cavities of the body, the surgeon in preventing and combatting sepsis in wounds and injuries, and the sanitarian in preventing the spread of infectious diseases. In other avenues of application there are as varied uses each special act of preservation having certain peculiar requirements to be met. In the field of internal medicine many valuable antiseptics are restricted in use or are not at all applicable owing to their toxic properties. The same precautions of selection must be observed in food preservation in addition to a care that the palatability of the food be not impaired. Poisonous antiseptics are not objectionable in the preservation of pathological or horticultural displays, but one must be employed that will not change the color or appearance of the specimen

and that will remain unclouded, if the specimen be submerged, so that the object preserved will not be obscured. Human bodies must be preserved with antiseptics that are not offensive themselves, that do not give to the corpse an unnatural appearance, that will not desiccate and that are easily applied. In brief the requirements of an embalmer's antiseptic for body preservation are ease of application and efficiency of action resulting in a lifelike appearance and safety to the public. Nothing short of the first requirement will satisfy the embalmer; nothing short of the second will satisfy the friends and nothing short of the last will satisfy health authorities. Thus it will be seen there must be a large list of antiseptics in which the operator must be skilled in selection in order to meet the numerous and varied conditions and requirements demanded of him in the application of means of preservation. That which will prove ideal under some circumstances may be of no avail at another time and under other conditions and the time is now here when he who would succeed in these fields must be conversant with the various properties, chemical and physical of the agents he employs. For a further consideration of special antiseptics and the choice to be made under varied circumstances the reader is referred to a work on the Chemistry of Embalming by the author.

CHAPTER IV.

Disinfection.

Of the many questions to be considered by the sanitarian and embalmer there is no more important one than disinfection and there is no other line on which he should be examined so closely, for on his appreciation of its importance and on the degree to which he is thoroughly conversant with the various methods and their relative value in given cases depend the lives and financial interests of the public. Professional pride and close competition for business will force the embalmer to employ successful methods of embalming and up-to-date funeral etiquette, but a perfectly preserved body and a smoothly conducted funeral do not necessarily imply a freedom from wholesale infection of the public with disease germs that may claim their scores of victims and nothing short of a thorough and practical knowledge of the necessity of complete disinfection and the means of effecting the same, so forcibly presented as to fully acquaint the operator with his responsibility in this direction will insure to the public any degree of protection whatever. The one who is not thus informed may be forced by public opinion or the law to employ some means of disinfection but he will naturally resort to those methods that are the most convenient and easy of application regardless of efficiency or special adaptation to any given case and when called on for certificates of proper disinfection will either

ignorantly or wilfully certify the work has been properly performed, when in reality only a form of disinfection has been observed and no real good has been accomplished. It is easy to understand how such a lack of definite knowledge on the part of an individual frequently coming in contact with the most destructive and virulent micro-organisms may be and unquestionably often is the occasion of a widespread infection of even an entire community. Antiseptics which were treated of in the preceding chapter will accomplish all that is desired in the preservation of a body in life-like appearance and will obviate unpleasant odors, etc., but disinfection alone can render a body, a room, persons or things that have been in the presence of infection, safe for public contact.

At the present time there are three ways of accomplishing a disinfection i. e., the complete destruction of the infection or contagion; first by fire; second by heat, either dry or moist; third by chemicals. In addition to these three means of disinfection there are mechanical measures by means of which the processes may be aided materially. These different means of disinfection have each much to recommend and each has some objectionable features that can not be overlooked.

In fire we undoubtedly have the most effective of all means of disinfection destroying as it does all organic structures. It is applicable to all forms of disease germs, but owing to this same property of destroying organized matter and materially effecting metals and many inorganic substances it can only be employed in a limited number of cases. The most practical application of fire is where the seat of the infecting agent is

some utterly worthless article or something that can in no other manner be disinfected. That it is thoroughly effective is obvious. It may often be made practical, too, by thoroughly mixing the infected material with some combustible matter and then consuming the whole, as mixing feces with sawdust or straw and applying fire. Where other methods have proven futile entire buildings have been razed by this destroying element for the sole purpose of removing a source of infection.

Dry heat to be effectual as an agent of disinfection must be applied at from 100 degrees C. to 250 degrees C. and must be prolonged from one-half to several hours, depending on the nature of the article, its resistance to heat and the organisms to be destroyed for not all are affected by heat alike. It is true most bacteria do not maintain an active existence above 55 degrees C. or 60 degrees C., but they are not destroyed by these temperatures and when once a lower temperature is reached they are again active. In other words a temperature of 55 degrees C. or 60 degrees C. acts only as an antiseptic, not as a disinfectant. To act as a disinfectant dry heat must be prolonged as above mentioned until germ and spore are destroyed. This prolonged action of dry heat is injurious to fabrics and colors, so that the applicability of dry heat for this purpose is quite limited. It may be also very properly objected that dry heat is not easily controlled and that one can not be sure all of the material to be disinfected is reached by these high temperatures.

Moist heat is usually applied in the form of steam or boiling water and as such we have a much more effective and practical agent, one that is of broad application. Moist heat to act as a

disinfectant does not need to reach that high degree necessary in the application of dry heat, neither need the application be for so long a time. Boiling from twenty to forty minutes destroys all pathogenic bacteria and is easily applied to all articles of clothing, not injuring even delicate fabrics. Where steam is applied for disinfection purposes it should be under pressure thereby rendering it more effective. There are on the market numerous forms of steam sterilizers (disinfectors) that make this a most desirable and convenient manner of securing a disinfection. Steam is the agent employed in most hospitals for the disinfection of towels, linen, blankets, etc.

In chemicals we have a long list of disinfectants that are effective or not just as they are understood and properly selected and applied. In selecting a chemical disinfectant one must consider its power over the germ to be destroyed, its effect on the articles to be disinfected, its probability of reaching all points of infection, the quantity necessary to be effected and its cost. A chemical that will effectually destroy some bacteria may be almost powerless with others so that to choose intelligently from the long list of chemical disinfectants one must have a complete knowledge of each and its germicidal power over the various bacteria. This knowledge must also include a thorough understanding of the effects of these various agents on fabrics, colors, metals and all other substances likely to require disinfection, else an agent may be employed that will ruin valuable articles as completely as though the disinfection had been by means of the simplest method, that of fire. Again it is obvious to be effective as a disinfectant a chemical must reach all parts of the infectious matter and in

sufficient quantities to destroy germ life. Almost every one knows that formaldehyde is destructive to germ life, but no one would suppose a drop of forty per cent. solution would effectually destroy a barrel of microbes and yet this is scarcely more absurd than the sublime faith so confidently reposed in some of the old time methods of fumigation and disinfection as practiced by the uninformed. Some of these methods as practiced are worse than no effort at disinfection at all since they inspire a false sense of security.

The subject although practically unlimited is worthy one's closest study and untiring application for as stated above, on it depends not only property interests but indeed the lives of the public.

CHAPTER V.

Personal Disinfection.

Figure XIII.

The work of the physician, the health officer and the embalmer is peculiar in that it calls for an entrance into the presence of the most virulent and dangerous contagium and at the same time demands that they come out and mingle

with fellows, and that without hazarding the lives or health of others. Members of the family or other individuals exposed to dangerous diseases may be held in quarantine until all danger is past and the clothing, etc., may be disinfected by slow processes but not so with the physician, the health officer and the embalmer. These must at all times enter into the presence of diphtheria, smallpox, yellow fever, etc., and on a moment's notice must be ready to leave these places to mingle in society or to enter into the homes of others not exposed to the disease in question. How shall this be done and what precautions shall I take to avoid contracting these diseases myself or carrying them to others are questions of paramount importance to every one following these professions.

Whilst of most and probably all transmissible diseases the cause is to be found in the ever present micro-organism its actual presence has not been demonstrated in all. Be that as it may the essential thing to know is how the elements of contagion or infection are transmitted and how the transmission may be prevented. The various forms of contagia are to be found in the air, the food, drink, excreta and all that comes in contact with the infected. The air, food, drink, bites and stings of insects, etc., are however the most usual carriers of the offending agents. It is obvious from the above the one who comes in contact with the transmissible diseases must be well guarded in his operations to avoid all possible sources of danger.

One is most likely to carry infection away in the clothing, beard or hair although it is quite possible to distribute it from the hands, the mouth or even shoes and since there is no more practical application of the old adage, "An ounce of prevention is worth a pound of cure," than to

Figure XIV.

the question in hand it is in the province of these pages to tell just how one can go in and out from the presence of the unclean thing and yet not defile himself or his neighbor and to give this in a practical form that can be put into practice at trifling expense. Formerly when any thing

at all was attempted in this direction the process was quite simple. The clothing was changed and hanged out to the air and sun for a short time to be donned again the next or perhaps the same day. The hands and face were washed and all thought to be safe. Occasionally some over-cautious person sacrificed his clothing to the disinfection of fire but only after exposure to such a loathsome disease as smallpox. Later antiseptics (mild) were used in washing the hands and face and the clothing was lightly sponged with a weak solution of carbolic acid or in some instances fumigated after a manner with sulphur fumes, better than the first but still inefficient. The methods now at our command are very simple, inexpensive and at the same time absolutely safe.

First as to clothing. Every one whose business takes him to the presence of the communicable diseases should have an air-tight cupboard or wardrobe and some means of generating formaldehyde gas. Into this cupboard he should place his clothing and other articles to be disinfected and the generator should then discharge into the container a volume of formaldehyde gas until it shall have reached a concentration of at least two per cent. One pint of a forty per cent. solution of formaldehyde will, when judiciously handled, produce about fifty cubic feet of gas or enough to properly disinfect 1,250 cubic feet of space. The amount of forty per cent. solution and resultant gas can be calculated from this base. The articles to be disinfected should be left in the presence of this gas for not less than twelve hours. When a complete change of clothing, the cabinet or the generator are not convenient the following makes a very good substitute

method of handling these cases: Let the operator be provided with a satchel and a long gown (see figures 13, 14, 15, 16, 17, 18) that will completely cover from the neck, (better still if a hood be attached) to the floor. The one I use covers even the shoes and their soles. Before

Figure XV.

entering the presence of contagion let him don this gown and on leaving let him remove it placing it in the satchel. The next step is to moisten a number of balls of absorbent cotton with a 40 per cent or better a 20 per cent solution of formaldehyde, place them around the gown and close

the satchel leaving it closed until required for use again. If the shoes have not been covered they should be lightly sponged (particularly the soles) with the same solution. The beard and hair must be cleansed with some good antiseptic for which purpose I prefer a weak solution of

Figure XVI.

carbolic acid. When the cap or the above mentioned hood is used the washing of the hair is of course unnecessary. Other articles exposed to the infection may be treated after the same rules.

Nurses and others who are in the presence of diphtheria are frequently observed to have in

the mouth, nose and throat numbers of the bacilli of diphtheria. If of diphtheria why not of other diseases? For this reason the mouth, throat and nasal passages should be washed out with a mildly antiseptic solution for which purpose the alkaline and antiseptic tablets of Seiler or a dilute solution of listerine are admirably adapted. The operator's hands, unless protected by rubber gloves, are the members necessarily contaminated in handling dead bodies. Too, these are most likely to be slighted in the process of disinfection. The surgeon who enters upon an operation of any magnitude whatever is inexcusably negligent unless his hands are thoroughly disinfected by one of a number of approved methods one of which is as follows: First thoroughly wash in hot water frequently changed for ten minutes using freely a stiff brush and green soap or the ordinary soft soap of the kitchen. This is to be followed by immersing the hands in a hot saturated solution of permanganate of potassium until stained a nut brown. Next the hands are immersed in a saturated solution of oxalic acid as hot as can conveniently be borne. The application of the acid solution should be prolonged until all traces of discoloration from the permanganate of potassium have been removed. They should then be rinsed in pure sterilized water or lime water. The concluding steps of hand sterilization should be washing in alcohol or ether or both. Curiously enough nail scrapings or scrapings of the skin after the above mentioned cleansing with soap, water and brush, frequently show the presence of large colonies of micro-organisms showing the inefficiency of mere soap and water cleansing after contamination with disease producing germs.

I do not know that the same or some other fully as vigorous process should be employed by the embalmer and sanitary officer but at the same time I am not ready to say that it should not. What I do know is that the usual careless methods of hand cleansing practiced by embalmers and too frequently by physicians and surgeons is quite insufficient and it is much better to err on the safe side than the unsafe. In cleansing the hands some powerful germicide should be employed in sufficient strength and for sufficient length of time to insure hands free from the presence of death dealing micro-organisms.

Figure XVII.

Protection to one's own person, aside from the rights of the public, demands a more rigid and thorough, conscientious adherence to the written and unwritten laws of sanitation applying particularly to the principles of personal disinfection.

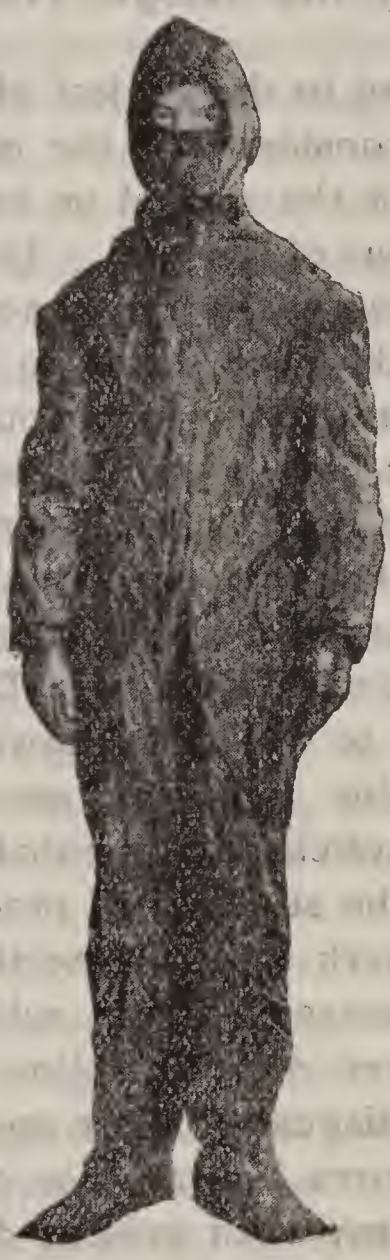


Figure XVIII.
The author's one-piece sanitary suit.

CHAPTER VI.

Wounds of the Knife, Needle, Etc.

Closely related to the subject of Personal Disinfection just considered is the matter of infectious wounds of the scalpel or needle, or infections of abrasions of the skin. That this poisonous nature belongs to instruments that have been used on the dead seems to have been impressed so thoroughly on the public that with many there is a holy horror at the suggestion of handling a dead body and to their way of thinking there is no hope for one so unfortunate as to sustain an injury from an instrument that has been in contact with a corpse. This idea is not at all confined to the laity, however, having a very considerable following among the inexperienced of physicians and embalmers. A large percentage of the students of practical anatomy enter on the work in the dissecting room with hands either protected with rubber gloves or smeared all over with vaseline to the great amusement or disgust of older operators. Under such circumstances I remember once hearing a noted surgeon say with evident disgust, "A cat can't catch mice with gloves." The force of the argument has since appealed to me strongly. There is some excuse for the use of rubber gloves in the event of a surgeon being forced into an autopsy, the gloves being worn, however, to protect patients on whom he is to operate and not for self-protection. I have witnessed a student

after having received a slight injury while dissecting, rush pell-mell down four flights of stairs to consult an official of the college as to his probable chances and what he should do to prevent the much talked of and greatly to be dreaded "blood-poison." I have no desire to ridicule the idea of any danger in such cases, for as stated above there is an element of danger. However, as a matter of fact, not one such wound in a hundred, I believe one might be safe in saying not one in a thousand, occasions any other disturbance whatever than the fear of what may be. Further, the human body is no more likely to produce these infectious processes during its decomposition changes than is the body of any other animal dying under similar conditions.

Not all human bodies seem to possess this power of infection in the same degree. Bodies of persons having died from diseases septic in character, such as typhoid, erysipelas, "blood-poison," etc., are much more likely to occasion the infection of wounds than others. Too, bodies full of fluids seem to be more toxic in character than spare ones. For the above reasons probably, the laity have come to entertain a dread or horror of handling bodies dying from "blood-poison." It is for this same reason no doubt they so often in such cases needlessly resort to fire for the destruction of bedding, etc., that might easily have been disinfected by proper fumigation or boiling. These wrong impressions as to the probability of infection and the proper means to avoid it are responsible for the destruction of much valuable property annually.

The operator is a factor of no little importance in this matter of infection of dissection wounds. Not all depends on the body. With some the

slightest scratch is sufficient to occasion the most violent symptoms whilst others seem to possess a degree of immunity that is hard to understand. Something, much perhaps, depends on the state of health of the operator. A person reduced from disease processes, particularly a person with deranged stomach or disturbed condition of the intestinal tract, should not expose himself to the possibility of an absorption of toxic factors even by placing the hands in contact with the fluids of decomposing bodies for such persons seem peculiarly susceptible. Fluids of decomposing bodies should here be understood to include the discharges from extensive septic wounds, either ante-mortem or post-mortem.

Under the above conditions of health it is not essential an abrasion of the skin should exist in order that poisons may be taken into the operator's system. The author has received almost numberless wounds, both slight and extensive, while demonstrating on the cadaver and apparently with no more serious results than occasionally the formation of a few drops of pus during the process of repair. Even the percentage of these wounds showing pus formation is scarcely greater than in wounds from general causes. A few days of very acute suffering with marked constitutional disturbance was once experienced from cleansing a very foul gunshot wound. There were no skin abrasions through which the poisons might enter, but there was an empty and markedly disturbed stomach before handling the case. These personal equations of the operator will be further considered in a subsequent chapter.

The infective principle of decomposing bodies is most virulent a few days after death and gradually lessens after some days; wounds made

during a post-mortem examination before the body has cooled (in certain cases) and for a few days after death being much more liable to infection than wounds made while operating on a body that has lain for weeks on the dissecting table and that is in an advanced state of decomposition. The peritoneal and pleural fluids and sites of suppurative processes are more likely to furnish the toxic agent than other parts of the body. Personally I should fear the peritoneal fluids more than any other part of the body. Bodies that have been injected with some efficient preservative are comparatively free from elements of danger.

The exact nature of the infecting agent has not as yet been fully determined. It is believed by some to be a living organism or germ that enters the system operating after the manner of other pathogenic micro-organisms. Others believe it to be of a chemical character resembling or identical with the ptomaines which are chemical bodies alkaloidal in character. These ptomaines are about fifteen in number; those that are toxic in character, not all being poisonous, resembling the vegetable alkaloids somewhat in their action. They are the agents which so frequently occasion poisoning from the eating of canned meats, fish, etc.

Though usually referred to as cases of "blood-poison" the cases of poisoned or dissection wounds are not always a true example of "blood-poison," but often more nearly resemble a case of surgical fever. Particularly is this true of the mild cases. The difference, however, need not be given here since "blood-poison" is to be discussed more freely under another caption.

After an absorption of the infectious matter either through wounds of infected instruments or direct infection of previously existing wounds of the skin, the first manifestations of a disease process are a sense of danger or malaise followed by a chill, fever and thirst. This is soon followed by pain in the arm, the hand being the member most usually infected. There is also some pain in the chest on the side corresponding to the point of infection. The course of the lymphatics is shown by red lines. The veins become knotted and painful. The glands of the axilla become swelled and inflamed and the skin hot. Respiration and the pulse become accelerated, the appetite is lost, the bowels become loose or flatulent and in short the patient passes into what is termed a typhoid state — not typhoid fever, but a condition in which the symptoms resemble those of a low typhoid state. At the point of infection a vesicle appears and is soon changed to a pustule. Serous blebs are formed along the arm, delirium follows and is in turn succeeded by death. The above outlines the course of a fatal case the entire duration of which may not be longer than a week or ten days.

The treatment of these cases resolves itself into two parts — prophylaxis and cure. The operator should always examine the hands for abrasions of the skin, such as hang-nails, etc., before entering into the work of any operation and where these exist they should be carefully protected by flexible collodium or rubber gloves. If in the course of operating a wound occurs it has been the practice to at once cauterize it with carbolic acid, apply collodium and proceed with the work. The practice is irrational in the extreme. The thing that should be done is to at

once favor bleeding by a process of suction, nor should there be any waiting to wash hands. If too much soiled to apply to the mouth, wipe the part well with a handkerchief or anything at hand, and see to it there is a free flow of blood either by means of pressure or suction with lips. However, should the lips be used one should be certain no abrasion of the mucous membrane exists. Following this and before proceeding with the operation it is proper to protect the point of injury from further danger of infection by proper bandages or collodium. After the operation is completed the hands should be thoroughly disinfected and the collodium removed. There is no real necessity for the use of carbolic acid at all, but where the injury is to an extremely nervous person it may be well to apply a little after the free flow of blood and before dressings are applied, solely for the mental effect. After the disease process has started the treatment should be left entirely to a competent surgeon.

CHAPTER VII.

The Body—How Shall it be Prepared?

Having disposed of the questions of personal protection of the operator and how he shall avoid carrying infection from his cases to the public, the next problem which confronts us is what shall be done with the body — in what way must it be handled and prepared that the public and friends may observe their usual rites with a degree of safety that is nothing short of absolute certainty?

Much has been written and more said as to just when the embalmer's or undertaker's work and responsibility should begin, some advocating that he should not be called until after the body has been washed and laid out, insisting the work of the embalmer can be done more effectually some hours after death than at once. Others insist the undertaker should have complete control of the situation as soon as he can reach the case after dissolution. My personal views are with the latter since in cases of infectious or contagious diseases much damage may be done through a careless or ignorant disposal of bedding, clothing, etc. True if present the physician could direct as to the propert course to pursue, but as a matter of fact but few of a physician's deaths occur in his presence and when they do his attention is frequently required to render service to other members of the family. Again, I had much rather prevent a germ activity such

as occurs in a putrefactive process than to combat it when once started and for that reason if for no other advocate an early embalmment. The embalmer then should be called at once when dissolution has occurred.

It is not the purpose to discuss methods of embalming, but as stated above to state in just what manner a body should be prepared to be handled with perfect safety, to give in detail the various steps in such a process but to omit all discussions as to what vessels should be raised and what fluids used. It is for the sanitarian to say what must be accomplished and for the embalmer to say what particular methods are most practicable, are best suited to the case in hand.

The undertaker or embalmer should possess a knowledge of the cause of death, the nature of the disease and an intimate acquaintanceship with the nature of the infectious agent. A case of typhoid fever differs materially from a case of diphtheria and the preparation of the bodies for burial in compliance with the laws of sanitation differs almost if not quite as much as do the diseases. Measles is a type of another distinct class and cancer differs quite as materially. A perfect understanding of all these diseases and the nature and distribution of the causative agent is essential to success. In a limited work such as this it is not practical to discuss in detail all the varying conditions that must be met. Only a general plan or outline of action or treatment must suffice leaving the reader to supply the essentials of detail that will be suggested by the peculiarities of the diseases to be handled.

The first real work of the undertaker consists in the removal from the room of the bedding and clothing of the deceased, the body having been

placed on a board covered with a cloth or sheet. Following any other course the operator would necessarily come in contact with infected material in the work that is to follow. Again in the struggles or relaxations frequently attending dissolution involuntary discharges from the various orifices of the body occur which are frequently highly offensive and infectious and which must be removed before anything like a sanitary cleansing process can be instituted. In the removal of bedding and clothing two points should be observed; not to be careless in raising dust and to have at hand a vessel containing an antiseptic solution in which to immerse the articles removed. The bed itself should be sponged with the same solution and mattresses put aside to be disinfected later with the room. In the event the bed is of straw the straw should of course be burned.

The body should now be washed thoroughly using plenty of soap and friction after which it should be sponged with a strong antiseptic. The washing of a corpse is usually performed in a very perfunctory manner of no service whatever. To be of any service at all from a sanitary point of view the washing must be very thorough.

The next proceedure in the preparation of a body for burial should be the removal of gases from the cavities using the trocar and canula. This step is made necessary from the tendency of these gases, through their pressure power, to force fluids from the orifices and through this same power to interfere with a full, free and complete circulation in the embalmment to follow. These gases are very offensive and often toxic in character and should be passed through some strongly antiseptic solution by means of a rubber

tube attached to the canula — given a chemical washing.

The case is now ready for the embalmment proper and it is hardly necessary to add this should be done most thoroughly, using both cavity and arterial work. The contents of cavities can not be reached effectually by arterial work alone and the converse is true. Concerning methods and fluids nothing need be said other than fluids and methods of known efficiency should always be employed and these selected with a special reference to the needs of the case in hand.

Having completed the embalmment all orifices of the body should be closed and sealed with cotton and collodium. This step should follow the embalmment since by pressure it would interfere with a perfect circulation, and in placing the cotton it is well to observe some care so as to not distort features. In addition to the above certain cases require a wrapping in an antiseptic sheet or a wrapping of absorbent cotton at least one inch thick.

At this time the corpse may be dressed for burial and placed in the casket. Opinions differ as to just when the body should be placed in the casket but my idea is the earlier the better, providing always the above mentioned precautions have been observed and the operator knows his embalmment has been thorough and sufficient. The cover need not be placed on at once but once closed tightly the casket should not be reopened.

CHAPTER VIII.

Room Disinfection.

The disinfection of rooms is a mutual responsibility of the doctor, the undertaker and the health officer and yet I presume no phase of the work is more neglected. Doubtless each expects the work to be looked after by the other and in this lack of personal interest is to be found the real fault. The health officer should know what to demand and that his demands have been executed before raising quarantine. The doctor should know what is essential that he may lend his support, moral and professional, to the efforts of the other two. The undertaker being in charge should be fully acquainted with the requirements, the reasons for them and methods of executing the demands of the authorities. All should recognize the necessity of harmonious action that objections of the uninformed or careless may be met and overcome.

Figure XIX.
Schering's Formaldehyde Lamp.

Figure XX.
Schering's Formaldehyde Disinfector.

Figure XXI.
Economist Disinfector.

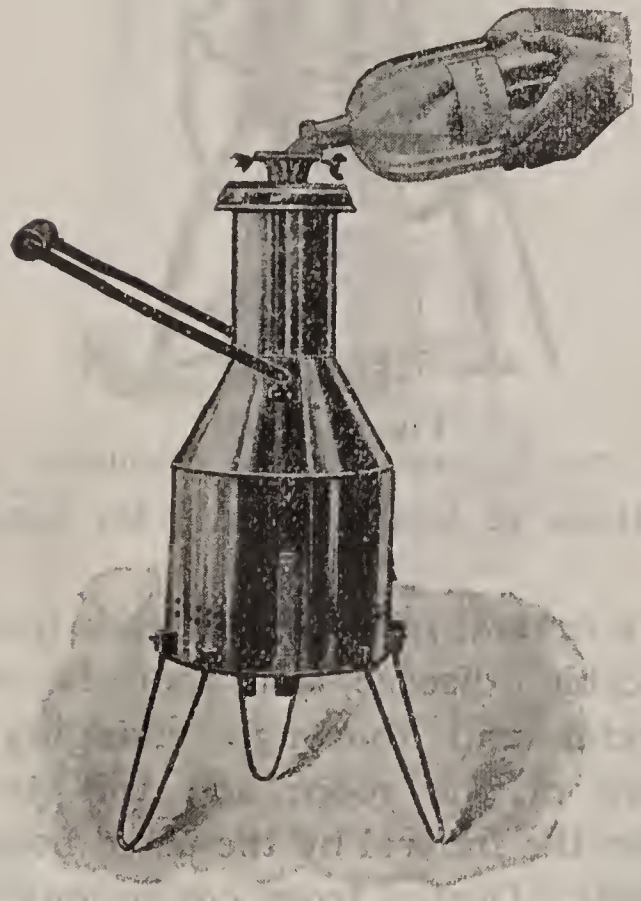


Figure XXII.
Trenner Lee Formaldehyde Disinfector.

The several health boards have outlined various methods of room-disinfection any one of which may be efficient or not depending on the thoroughness with which it is applied. The practice of spraying a room with a few ounces of some proprietary disinfectant or deodorant (and too frequently a deodorant is regarded as a disinfectant, which it may not be at all) from a small atomizer is not a sufficient disinfection and is not the interpretation that should be placed on

Figure XXIII.
Truax, Green & Co.'s Autoclave.

the directions of health boards for spray disinfection.

Before a funeral following a death from a non-communicable disease all that is necessary is a careful and thorough changing of the atmosphere of the room and this to be followed after the funeral by the usual house cleaning methods. Deaths from contagious or infectious diseases imply more thorough means of

protection. In some of these infectious diseases of which typhoid fever and dysentery are types, a funeral may be held in safety after having aired the room and swept it with a broom moistened in some antiseptic solution; but after the funeral the room should be thoroughly

Figure XXIV.
Lentz Formaldehyde Generator.

cleansed after one of the methods to be hereinafter described. In other classes of infectious or contagious diseases where the causative factor is of a more virulent type, such as is found in the acute exanthemata, diphtheria, etc., before the public are admitted there should be a disinfection

by means of some gas, the means of generating which may be found below. In these cases it is well to make doubly sure by following with some other methods afterward.

In cases not recognized as distinctly contagious or infectious or for mildly contagious or infectious cases a very satisfactory method is a thorough cleansing of walls, ceiling and floors with soap and water which should be applied hot. Necessarily the amount of water which could be applied to a plastered wall is limited. Carbolic acid, borax, alcohol, bichloride of mercury or lime added to water makes it more

Figure XXV.
Francis Formaldehyde Generator.

Figure XXVI.

Sternberg Disinfector.

efficient and applicable to a larger field. It must be remembered, however, that any disinfectant is valueless unless employed in sufficient concentration and quantities to insure the destruction of pathogenic organisms. In order to be effective bichloride of mercury should be of a strength not less than 1 part in 1,000 parts of water; carbolic acid should be 5 per cent.; chloride of lime should contain not less than 25 per cent. of available chlorine (6 ounces to the gallon of water, using the commercial chloride of lime) and the cost of any of the above is so small as to be inconsiderable. After the use of these agents there should be another general cleansing with a free use of hot water.

Figure XXVII.
Durfee Disinfector.

Wall paper is frequently cleaned by a process of rubbing with glutinous bread or some similar substance, sweeping and scraping. The process is not applicable to roughened or cracked surfaces and is objectionable from the fact that particles of the bread will cling to the walls and afterwards drop to the floor subsequently scattering the organisms in the form of dust. In all cases the paper should be removed and the walls disinfected before repapering.

Fumigation with some form of gas destructive to microbic life has long been used as a disinfectant and sulphur fumes the most commonly employed. For a number of reasons I do not regard the agent as a good one though it will do

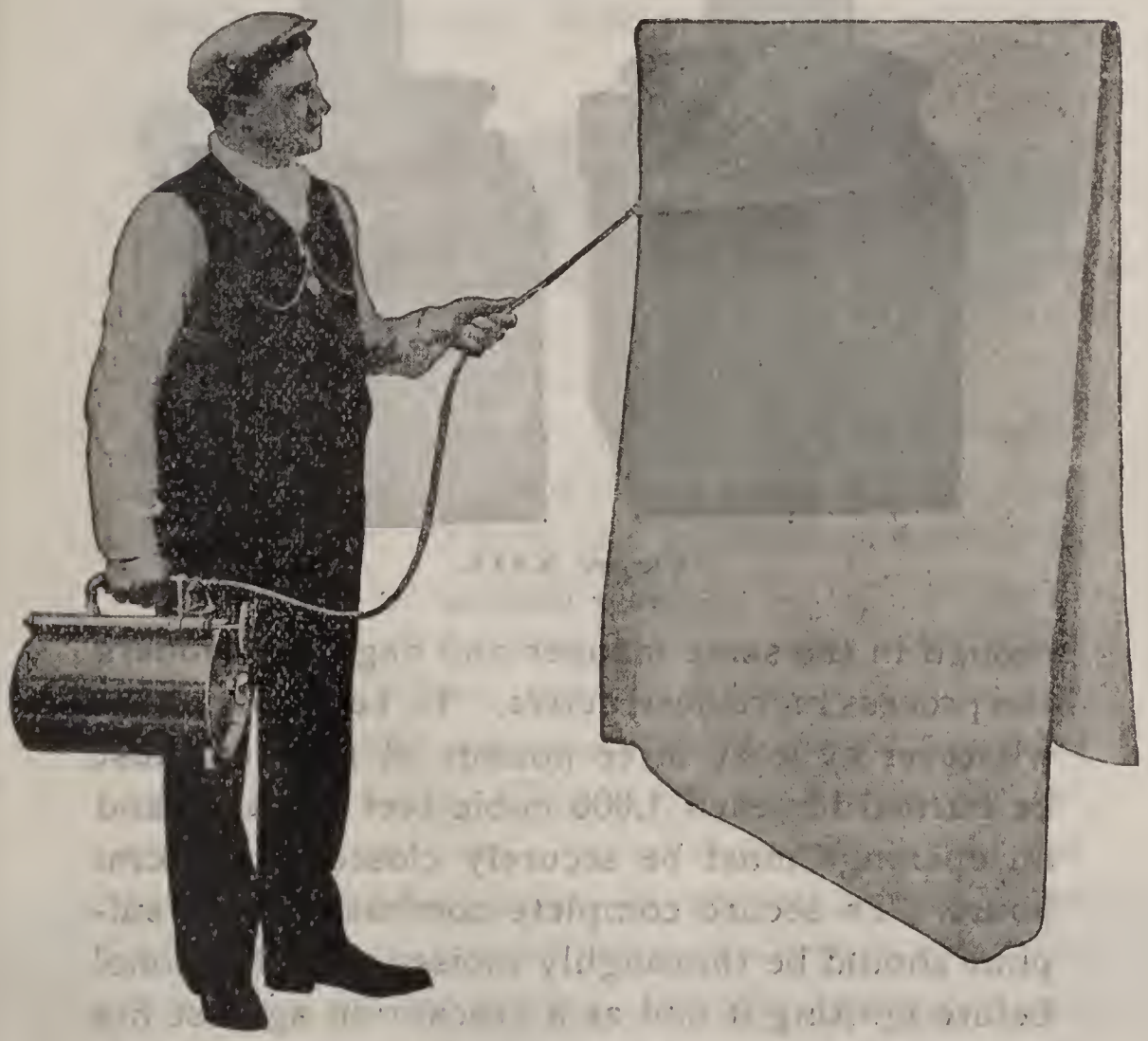


Figure XXVIII.
Compressed Air Spraying Outfit.

the work in some degree if properly handled. It affects only exposed surfaces and is injurious to many substances. This injury is due to the very process which renders it at all effectual as a disinfectant, a transformation of the sulphurous acid (H_2SO_3) to sulphuric acid (H_2SO_4) through an absorption of one atom of oxygen from the air. The presence of moisture in the air with the fumes renders the agent more effectual. Indeed this presence of moisture is essential

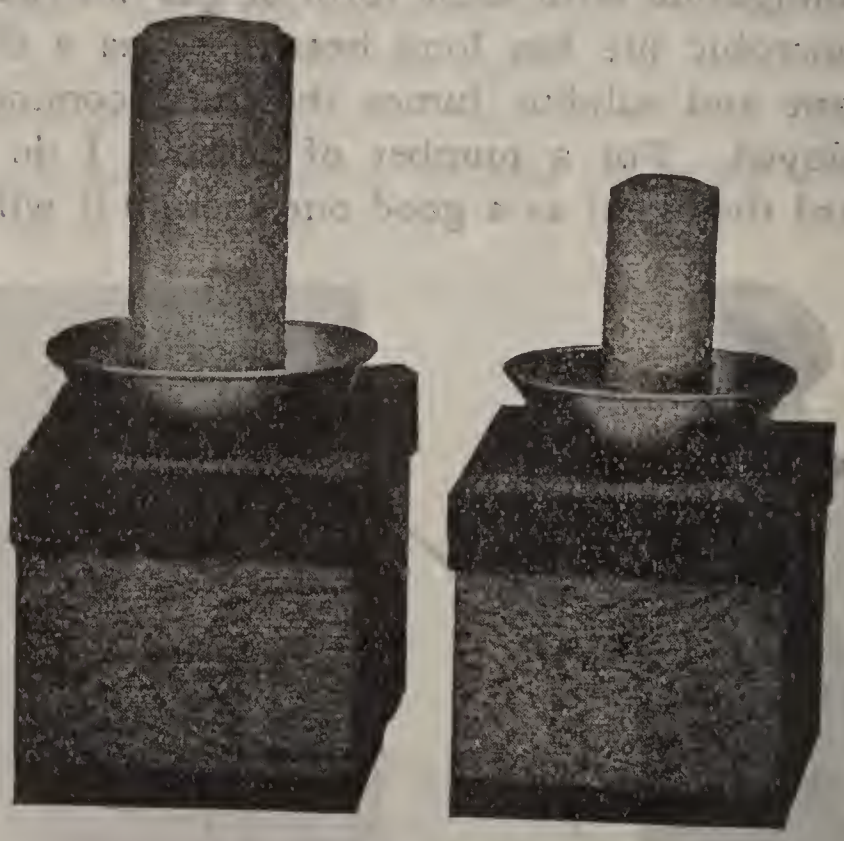


Figure XXIX.
Sulphur Candles.

though in the same manner and degree it renders the process more destructive. To be of any value whatever at least three pounds of sulphur must be burned for each 1,000 cubic feet of space and all openings must be securely closed for several hours. To secure complete combustion the sulphur should be thoroughly moisened with alcohol before igniting it and as a precaution against fire it should be burned in a vessel surrounded by water.

The best means of room disinfection at our command is, in my judgment, formaldehyde gas, since it is safe, efficient and not injurious to fabrics or metals. To be effective, however, it must be introduced into a room to the extent of not less than two per cent and the time of exposure should be not less than twelve hours. This gas may be generated by a variety of ways; either sprinkling a diluted solution on the floor, bedding, etc.; sprinkling suspended sheets with a 40 per cent solution or the same diluted; by heating the 40 per cent. solution to 70° F after adding ten per cent. calcium chloride to prevent polymerization; or by means of specially constructed appliances for the combustion of wood alcohol or pastiles of formalin. Where the gas is to be gen-

Figure XXX.
Sulphur Torches.

erated from wood alcohol no appliance is sufficient that will not consume one quart of the alcohol per hour. Where the solutions are used as suggested above, each 1000 cubic feet of space calls for one pint of the forty per cent. solution of commerce. When properly handled one pint of the 40 per cent. solution should evolve about 50 cubic feet of gas. This is stronger than the required two per cent. Indeed it should be five per cent but not all so-called 40 per cent. solutions are reliable and it is much better to err on the right side than on the wrong. Another effective and simple method of disinfection may be mentioned. This method is safe and requires no special

apparatus. About thirteen ounces of permanganate of potassium are placed in a three gallon vessel in the room to be disinfected, the room previously warmed. Over this permanganate of potassium is poured two pints of forty per cent. formaldehyde, the operator leaving the room at once and closing it tightly. The room is kept closed for five or six hours at which time the disinfection should be complete providing the room has been properly prepared by opening drawers, etc., and disarranging contents, bedding, etc. The above amounts should be used for a room of 1,000 cubic feet. True this method requires more formaldehyde than is usually recommended in other methods, but the safety and simplicity of the method should compensate for the additional amount of chemicals required. After disinfection by means of formaldehyde gas a room may be quickly cleared of the gas by free ventilation and sprinkling floors with aquae ammonia. In disinfection of rooms by means of any gas all drawers should be opened, clothing and bedding spread out and all openings from the room tightly closed.

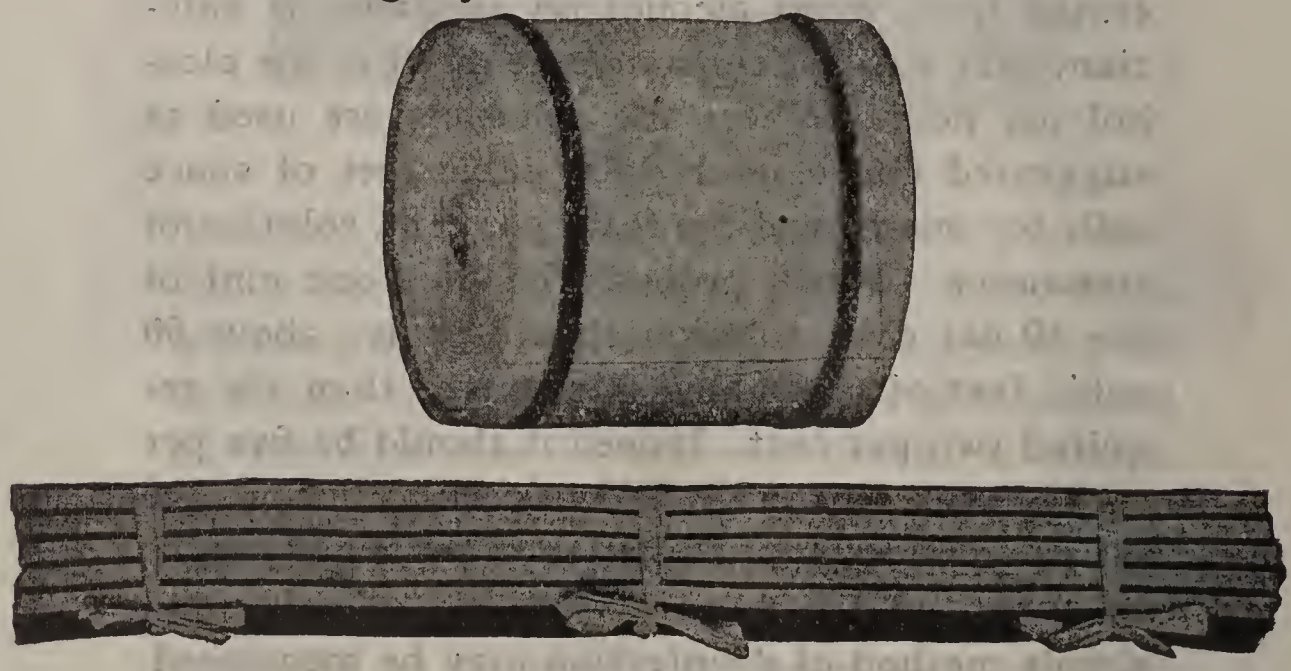


Figure XXXI.
Gummed Sealing Strips.

CHAPTER IX.

General Observations on Funerals.

It might not be out of place in this connection to offer a few general observations on funerals from a sanitary point of view, including an array of sanitary considerations not easily classified but none the less important because of this difficulty.

The tendency of latter days to make the disposition of our dead a display, a place of amusement or entertainment for many, a show in plain terms, has grown to such proportions that an overcrowded (even to overflowing) house or church is no uncommon occurrence. Draughts of air from open or constantly opening doors are under such conditions unavoidable, and coming as they do at a time when the vital forces are greatly reduced through loss of sleep and grief they can not be other than productive of evil results. Recently much importance has been given to dust as a carrier of disease and numerous ailments have been classed under a general caption dust diseases. How such assemblages of people might act in the carrying of such infection and widely disseminating it through agitation by means of much walking on carpets and the sweeping of long dresses is not difficult to understand and needs no elucidation.

Another source of unnecessary exposure is found in the protracted delays sometimes met with which may be due to a tardy minister or undertaker or an unfinished grave. The case is

too plain to need comment and the remedy equally plain. Any one who accepts a responsibility in connection with a funeral service should let nothing prevent a prompt and faithful discharge of duty.

Numerous reasons exclaim against the practice of waiting at the grave until it is filled, more frequently observed in rural districts. The delay often means exposure to storms, wet grass, snow, extreme heat or cold. Hats are frequently removed during this part of the rite exposing the head to influences that cannot be otherwise than detrimental to health. Another feature of this practice is the nervous haste with which the sexton or pall-bearers close the grave. During the cool months this is perhaps not such a factor, but every one knows what a tax on one's energies it is to be hurried in the performance of an unaccustomed duty whilst friends of the deceased wait anxiously for the dismissal when they may be alone with their grief.

Kissing is regarded by all sanitarians as a dangerous practice, particularly the kissing of a sick person or corpse. One needs but a faint conception of the germ theory of disease to appreciate how dangerous such a practice might be, nor is the micro-organism the only factor to be considered. The various fluids of the dead body are not infrequently highly toxic aside from the presence of bacteria and the fluids used as preservatives are often of a poisonous character. These latter are sometimes present on the face in dangerous quantities. Kissing the dead is a practice that should not be tolerated under any circumstance.

Stories of self torture that come to us from heathen nations are shocking in the extreme and

it is hard to understand just how such a system has become so thoroughly established in some quarters of the globe, but as a matter of fact the intensifying of grief and suffering occasioned by our modern funeral methods, the constant visitations of uninterested meddlers, the public parades around a casket whilst gratifying curiosity under the garb of paying respect to the deceased and bereaved, and too often the remarks of the minister tend to increase rather than diminish the suffering of friends and in so doing lessen the disease resisting powers that are already overtaxed. The farewell of a family will tax their strength and powers of endurance less if taken in private. Under such circumstances the truly grieved and refined will feel less called on to control honest expression of grief owing to absence of vulgar intruders and the hysterical will feel less called on for violent demonstrations of a more evanescent sorrow. In either circumstance there is a conservation of energy much needed. Then what shall be the remedy to overcome this unnecessary waste of energy? Let the body lay in state sufficient time to permit all interested to call and view the remains. At a specified hour let the doors be closed, the relatives in private take their farewell and the minister in a few well chosen words offer what consolation he may, not dwelling on points that must call out renewed outbursts of grief. Then let the undertaker remove the body for final disposition, accompanied only by the immediate friends and relatives if by any one.

What shall be done with the body? Shall we bury or shall we cremate? Sanitarians nearly all with one accord say cremate but the public are not yet ready to give up time honored customs

on demand of science unless science shall give good and sufficient reason for demands. If the body has been prepared in accordance with the rules given on preceding pages it may perhaps be buried in perfect safety. The one great objection to a burial in the ground is a contamination of water with disease agents or poisonous preservatives. The latter is scarcely a consideration. The distance to which disease producing agents will travel and the obstacles through which they will pass is almost incredible, cases being on record where they have even passed through the base of a mountain and that not by means of an open direct current. To meet this element of danger in burial some have advocated the liberal use of quick-lime around the body by which it would be destroyed but the method will probably never become a popular one. The antiseptic absorbent sheet has recently been offered as a substitute for embalming or cremation as a health measure. The absorbent sheet is a valuable means of disease prevention as has been suggested on preceding pages but to attempt to make it serve in the capacity of substitute for embalmment or cremation is absurd in the extreme. The merest novice in principles of sanitation under the present theories of germ origin of disease must readily understand it could not be made to hold indefinitely or even for any considerable length of time. Neither could it be charged with sufficient antiseptic power to disinfect the entire organism and if it could the first fluids of the body passing through would wash away so much of the antiseptic agent the latter fluids would pass through unchanged.

That cremation is effective as a sanitary measure all will admit, but two points being urged

against it. It is alleged that in some cases it obliterates evidence of crime and that it is revolting to the finer senses. The first I am ready to admit but will any one insist it is not better to let one criminal go unpunished than through fear of this to permit a hundred innocent sufferers to die from disease induced through use of a water supply that has been contaminated from an improperly prepared body that has been buried? As to cremation being revolting to the finer senses, the consuming of a body by means of heat is certainly not more revolting than the idea of loved ones being eaten by worms or slowly disintegrating through the process of putrefaction, the once pink-tinted flesh hanging in blackened putrid shreds to a skeleton that has outlived its purpose. Cremation is certainly the sanitary way in which to dispose of the dead, is growing in favor and must soon unquestionably come into general use.

CHAPTER X.

Peculiarities of Communicable Diseases Including Susceptibility and Immunity.

A comparatively large per cent. of all the diseases which afflict the human race may be classified as communicable and therefore preventable. The full force of this argument does not come upon us at once but is all too apparent when one stops to consider in dollars and cents the cost of a small epidemic to a small community and then increases this cost to the many, many times necessary to show the cost to an entire county or state. A single case of typhoid fever, in which the sanitary instructions of the physician were not properly observed, resulted in the spread of the disease to the number of thirty or more cases, ten at least of which proved fatal. On a low estimate these cases would average sixty-five dollars for doctor bills. The ten funeral outfits would cost on an average of fifty dollars each. Estimate the time of the patient and two nurses for each patient at one and one-quarter dollars per day each for thirty days — that being a fair average term of sickness; add to this an estimate of five dollars per case, traveling expenses of friends visiting and board for three extra persons each meal for three weeks in each case, at three dollars per week; include an expense of ten dollars per case for drugs and incidentals; estimate each life at five thousand dollars; place a thirty-five dollar monument at each grave and tabulate the whole as follows:

Doctor bills, 30 cases, @ $65 each	$ 1,950
Ten funeral outfits @ $50 each	500
Time of patient and two nurses	4,050
Board, three extra people each case three weeks, @ $3 per week	810
Traveling expenses @ $5 per case	150
Drugs, etc., @ $10 per case	300
Ten lives @ $5,000 each	50,000
Ten monuments @ $35 each	350
Total	$58,110

Think of it, $58,110.00 unnecessary expense in three townships from carelessness in handling one case of typhoid fever. More than fifty-eight thousand dollars were wasted, worse than wasted in a few weeks. Think of what this must mean to an entire state or country. The Health Board of one state, perhaps not more afflicted than the average, has estimated the annual cost of typhoid to the state at over $5,000,000. One can scarcely comprehend the sum and yet it is being worse than wasted. Five millions of dollars for the privilege of entertaining so filthy a guest as typhoid fever for one year seems almost incredible. What a woeful waste when less than half the amount properly expended would practically stamp out the disease of filth and what would the balance not do if converted into legitimate channels?

Then stop just long enough to consider that typhoid is but one of the many preventable diseases making inroads on our numbers and means; that the above computations have not taken into consideration smallpox, diphtheria, cholera, etc., and the cost of quarantine measures to say nothing of the loss to business such measures necessarily involve. Dr. J. N. Hurty, of Indianapolis, Secretary of the Indiana State Board of Health,

is authority for the statement in Indiana alone are 100,000 people who must die of tuberculosis in some form, and so the statistics might be piled up until we should become lost in amazement and forced to exclaim "How long, O Lord! how long" will the people remain in ignorance of their own danger and continue to exclaim against those who seek to do them good in stamping out these scourges?

Communicable diseases are peculiar in that they may be transmitted from one person to another. There are four ways in which this transmission may be effected. First, the contagium, by which is meant the causative factor of the disease process, may be introduced by a direct inoculation, as is the case in vaccination and when a disease can be so introduced it may be referred to as inoculable. Many of the communicable diseases may be so classed. Second, the contagium may be directly conveyed to those in personal contact with the sufferer or through the air of the immediate vicinity such cases being referred to as contagious. The danger of contracting a contagious disease increases of course with the closeness of personal contact and decreases as one recedes from the infected. Third, the contagium may be taken into the system by way of the alimentary tract, to which it is conveyed in infected water or food. Fourth, there may be an indirect transmission by means of clothing, bedding, hair, beard, instruments, etc. Such transmission may be for almost incredible distances and be the occasion of widespread infection. The third and fourth classes above mentioned are usually spoken of as infectious. In such a classification as just given it does not necessarily follow that a disease which

is placed in one class may not fit equally as well in another class. Many of the communicable diseases are not only infectious but contagious and inoculable as well.

From the above it will be seen there is some little difference between the contagious and infectious diseases though these terms are frequently used interchangeably. In the contraction of a disease by contagion it is necessary to come in personal relation with — not necessarily touching but in the presence of — the one suffering from the disease in question. This personal contact is not necessary to contract a disease by infection, but the contagium may be conveyed by means of food, drink, clothing, etc. This distinction though not infrequently confused is of some considerable importance when it comes to a question of quarantine restrictions, since an ailment may be infectious and not contagious.

In many of the communicable diseases the exact nature of the contagium or infectious agent or causative factor as it is variously styled, is unknown. In others it has been clearly proven to be the ever present micro-organism or vegetable parasite commonly called germ or microbe. Just how these organisms operate to induce disease processes and why we know they do so need not be discussed here since the matter has received some consideration in earlier pages. Neither is it deemed advisable to theorize as to the probable cause, or its exact nature, of those communicable diseases not due to microbic origin since along the entire line of thought we are practically at sea.

Individuals and races differ in their susceptibility to the various communicable diseases from almost absolute immunity to a readiness to

"take" anything on slightest exposure. As an illustration some have escaped seizure after close personal contact with certain contagious diseases even sleeping in the same bed with sufferers whilst others as stated have succumbed to very slight exposure. Yellow fever and scarletina are less common among the Negroes than among others whilst this race is more susceptible to smallpox and tuberculosis. The Hebrews are relatively immune to tubercular affections whilst the Irish and North American Indians suffer greatly. This racial difference of susceptibility, however, is probably due more to conditions of living than to any inherent differences of organism. The seeming immunity of the Hebrews from tuberculosis may be easily accounted for by rigid inspection of meats according to old Mosaic law, since doubtless many cases of tuberculosis are contracted from the use of infected domestic animals among which tuberculosis is common. Cutting off this source of infection and taking into consideration that Hebrews but seldom intermarry with the Gentiles who have not this protection and one need not search further for a reason for this relative immunity. Dr. Theodore B. Sachs of Chicago, however, presents an article in the Journal of the American Medical Association (Vol. XLIII, page 390) which would lead one to conclude the so-called immunity of the Hebrew from tubercular affections is largely over estimated.

Susceptibility depends somewhat on the relative state of the individual's vital and chemical forces. To state it differently, general or local depression is an important factor. One whose vital forces are greatly reduced is obviously more susceptible to an infection and disease process than the same

individual might be in a more perfect state of health. To put it more specifically one suffering from debilitated conditions of the mucous lining of the respiratory passages would be much more liable to an infection from diphtheritic or tubercular organisms than the same individual with healthy air passages even though in the latter instance the exposure may have been for a greater length of time and in the presence of more virulent contagium. These varying conditions and general or local depression doubtless account for many of those numerous cases of individuals who have frequently been exposed to diseases with impunity and have subsequently contracted the affection from apparently very slight exposure.

Immunity from disease which has been mentioned a number of times may be defined as that state or condition of the system in which one will not contract an affection on exposure to its contagium. In a sense immunity is the antithesis of susceptibility and hence may depend in some degree at least on opposite conditions to those which favor susceptibility. The state of immunity may be either an apparent, a native or an acquired condition. Apparent immunity is not so much a state of the system rendering infection impossible as a combination of circumstances rendering infection improbable. It may depend on different circumstances. This apparent immunity in affections of bacterial origin, may result from a failure of the infective organisms to reach a tissue in which they can act or from a failure of the organisms to become arrested or again it may be the result of a particularly healthy body with increased powers of resistance or a superabundance of vital force.

Certain disease producing bacteria act only as such when they reach certain forms of tissue. Malignant oedema bacilli for example only produce the affection when lodged in connective tissue and when introduced into the blood current are not only powerless to produce the disease unless they find exit into the tissues but act as a factor in producing an acquired immunity against the affection. Many of the pathogenic organisms act only when arrested at some point and all are more potent in a state of rest. An apparent immunity may also result from the contagium being introduced into the system in insufficient amounts to overcome the resisting forces. On first thought it would seem considering the rapidity with which disease producing germs multiply, that the amount could scarcely be too small to induce the disease process, but such is not the case since the various fluids of the body including the blood are in some degree antiseptics or disinfectants and as indicated above the resisting powers of the system are often sufficient to throw off the offending agents. This is particularly true where the contagium is in small numbers or is in an attenuated form or where for any reason whatever the virulency has been lessened and hence again an apparent immunity. Persons with an apparent immunity who have been exposed to infection with impunity may at some subsequent period, as stated above, suffer an attack from a much less exposure owing to the absence of some one or more of the conditions which before conferred the immunity.

Natural or native immunity is an inherent state of being which renders one exempt from the disease process in question. Certain racial peculiarities as suggested above, for instance the relative

immunity of the Negro from yellow fever and occasional instances in which whole families seem to possess an immunity against certain diseases are very properly referred to as natural immunity. A very good example of natural immunity is also to be found in the lower animals, the horse being practically free from tuberculosis which is frequently found in the ox and swine. Too, natural immunity is sometimes most peculiar in its manifestations for which we are entirely unable to assign a good reason. For instance anthrax readily attacks mice but is impotent with rats. As intimated above just why these facts are true we do not know, but that they are true we know and accept them as such.

Acquired immunity may be defined as an exemption from a certain disease process due to some systematic change within the individual and may result from one of three processes: First, recovery from an attack of the disease in question; second, from an induced attack of an allied disease process; third, from inoculation. A first attack of many of the communicable diseases renders the individual free from any danger of subsequent attacks regardless of exposure. Instances are almost too well known to require mention. However, typhoid fever, measles — in short all the acute exanthemata belong to this class though there are exceptions to the rule with nearly all of them. A few of the communicable diseases, erysipelas for example, seem to reverse this order and tend to render the individual more susceptible with each attack.

The second form of acquiring immunity, by means of inducing an attack of an allied disease process which is immunizing, is best exemplified in vaccinia or the process which results from

introducing vaccine virus into the system and which renders an immunity against smallpox.

Immunity may be acquired as a result of inoculation in three different ways, i. e.: inoculation with attenuated virus of the disease; or inoculation with chemical products of the organisms of the disease; or inoculation with serum from an animal which has been immunized by one of the above two methods. Smallpox is again the best example of the first method of immunizing by inoculation. For many years in different countries it has been the custom to seek immunity from small-pox by artificially inducing a mild attack of the disease by inoculation. These artificially induced attacks are usually of a mild type but occasionally assume a most severe form. The virus in an attenuated form is secured by one of two methods — either repeated inoculation through animals but slightly susceptible thereby reducing potency or by exposure of cultures to environment that reduces their power. One very serious objection urged against this method of acquiring immunity through inoculation is that while it induces immunity from subsequent attacks it sometimes induces a severe instead of a mild type of the disease, as suggested above, thereby defeating the very purpose for which it was intended. For this reason other methods have been sought.

In the second manner of inducing immunity through inoculation the germs are killed by means of certain germicides, frequently oil of mustard, and the chemical product of these organisms is used. The process is far from ideal, not always reliable and not applicable to all of the communicable diseases due to parasitic fungi since some of them do not respond.

Serum inoculation from animals that have been treated by one of the above methods more nearly meets our ideal of immunity by means of inoculation and is the method most commonly employed. This is the process most generally known and the one used in the treatment as well as the prevention of diphtheria. In the preparation of this serum (antitoxine as it is usually called but more properly diphtheria antitoxine or anti-diphtheritic serum) a healthy young horse is selected and is inoculated with a small dose of diphtheritic toxines. These toxines are not to be confused with the bacilli of diphtheria but are chemical products of these organisms — see the paragraph immediately preceding this one. When the fever of reaction following this inoculation has subsided a larger dose is administered, the process being repeated in increasing doses until the animal is no longer affected by the toxines (not antitoxines) regardless of the size of the dose employed. In other words the animal has been rendered immune to diphtheria through a process of poisoning with the poisons generated by the germs of diphtheria. Just how this immunity is conferred is not known, but the fact is known. The animal is then bled, the blood being collected under aseptic precautions and the serum after being separated and combined with a preservative is put up for use in sealed packages. In some unaccountable manner this serum renders the subject into whose system it is injected, immune for a time from attacks of diphtheria. Incidentally it may be remarked, too, that this serum or antitoxine furnishes our best means of treatment of this same disease antagonizing as the name implies the poisons of diphtheria. Just what the agent is which accomplishes so much is

not known nor even thoroughly understood. There are numerous serums from as many different disease producing organisms but antidiphtheritic serum is the type as well as the most commonly employed.

The duration of immunity is of course varied and indefinite. Obviously an apparent immunity may cease at any time and racial immunity is as a rule only relative not absolute. Neither is there any definite time at which acquired immunity may be said to cease. Whilst in most instances in which immunity has resulted from an attack of an affection, either as the result of accidental exposure or artificially induced as a prophylactic measure, the exemption is unlimited, there are enough exceptional cases to the rule to make unlimited immunity a matter to be questioned in each individual case. The immunity from smallpox afforded by vaccination varies from a few years to a lifetime. In order to be sure therefore of an immunity through vaccination one should be vaccinated in early childhood, again at the age of puberty, again at the age of majority and as often thereafter as one is exposed to the contagium or the prevalence of an epidemic. In other words to be effective not only vaccination but revaccination should be practiced. The duration of immunity rendered by the various serums as for example antidiphtheritic serum is measured by weeks or months and must be repeated as often if renewed exposure occurs.

The theories regarding immunity from the why point of view are almost numberless. No one of the various ideas advanced seemed to hold good in all cases and since it is known the communicable diseases result from etiological factors widely differing in their individual characteristics may

it not be possible and is it not probable the specific reasons of an exemption from certain disease processes may be as varied as the disease processes themselves or their causative agents? Being so varied and so little understood it is not advisable to enter into a discussion of these perplexing problems. From the above may readily be seen that which to the sanitarian is one of the most important facts relative to the communicable diseases, namely, the communicable diseases are prone to occur in epidemics, the poison being increased many fold in each individual case.

These diseases are likewise peculiar in having a definite course to run including a period of exposure, a period of incubation, a period of onset, a period of increased activity, a period of declining activity and usually a period of immunity following. There is much variation of these periods in duration as well as other characteristics, in the various transmissible diseases each of which has a train of symptoms peculiar to itself and each of which usually adheres very definitely to certain laws of process common to all. So perfectly does this rule seem applicable that having been exposed and not immune one may with a reasonable degree of accuracy and certainty that approaches nearly to the absolute, predict just what will occur in a given case. Such are the peculiar general considerations of the communicable diseases, the prevention of which is one of the most important duties incumbent upon those to whom it is given to be guardians of the public health.

Part II.

Part II.

Special Considerations Relative to the Communicable Diseases.

Special Diseases.

In the previous chapters the discussions have been of a general character. In the pages which are to follow there remain to be considered certain special and peculiar features pertaining to each of the communicable diseases which are of considerable importance to all those who have to deal with these sources of danger. It does not suffice that those to whom is entrusted the public health to any extent, as for example the physician, the nurse, the embalmer and the minister, should know that certain disease processes are communicable and may be transmitted from one person to another but they should also understand under what conditions these affections may be transmitted. It is not enough that they should understand the necessity for quarantine measures but they should know when it is safe to remove these quarantine restrictions. An appreciation of the necessity of disinfection will avail but little without a knowledge of the best, or at least an efficient method in any given case and since in these particulars the communicable diseases differ widely a separate consideration of each is essential. The consideration of these peculiarities would logically follow at this point and will constitute the concluding pages.

Scarletina, Scarlet Fever.

SCARLETINA, SCARLET FEVER, OR SCARLET RASH is an acute infectious disease characterized by a peculiar rose-colored eruption, markedly sore-throat and a high fever. The disease usually attacks children under ten years of age though adults have been known to suffer from it. An attempt to ascribe to the disease a variety of forms, designating these so-called forms by the names heading the paragraph, has resulted in much confusion. As a matter of fact scarlet fever, scarlet rash and scarletina are synonymous — one and the same thing — and any attempt to refer to one case as scarlet rash or another as scarlet fever because of any mildness or severity of the symptoms is unfortunate and not to be encouraged since the milder cases of the disease may occasion the most violent and should be subjected to the same rigid sanitary restrictions. To repeat, the sanitarian should not forget and the public should be reminded on all occasions that scarlet rash, scarlet fever and scarletina are one and the same disease.

The specific cause of scarletina is unknown but from the close similarity in its clinical behavior to those diseases known to be of bacterial origin it is safe to assume that sooner or later some such microbic factor will be found and demonstrated. Whatever the infective principle may be, it seems to be received and taken into the system through the organs of respiration and is conveyed by means of personal contact, clothing, hair, paper, dishes, rags or discharges from the ears, nose, throat, skin, kidneys and bowels. Pet cats, birds

and dogs have also been known to spread the infection. Imperfect ventilation, filth and uncleanliness seem to increase the probability of infection and difficulty of recovery.

The period of incubation in scarletina i. e., the period from exposure to the first manifestation of symptoms is variously estimated at from one to seven days, some even extending the period beyond this time. Most authors seem to agree, however, on the following limitations — least, less than twenty-four hours; average one to three days; longest seven days. Usually on the second day but sometimes within the first twenty-four hours of the disease the eruption appears. It is first seen on the neck and later on the chest and extremities. The eruption appears in the form of slightly elevated, scattered red points on a deeply flushed skin. Occasionally are seen a few vesicles. The eruption generally lasts one or two days, sometimes longer, and then begins to fade. Following the eruption is a desquamation or peeling off process which usually lasts from ten days to three weeks, the skin often peeling off in great flakes. Desquamation is first noticed about the face and neck and follows the same order of progression as did the eruption.

The diagnosis of scarletina is to be made from the history of exposure, high fever, vomiting, pharyngitis, characteristic eruption, albumen in the urine and a peculiar elevated condition of the papilla of the tongue which has given it the name of strawberry tongue. Briefly, scarletina is to be known from measles by the eruption of the latter appearing in blotches and by an absence of the catarrhal symptoms usually present in measles. From rubella or rotheln it is to be differentiated

by the presence of albumen in the urine, by its slower development and in the latter disease a lower temperature and less violent sore throat. The diseases are frequently confused. A safe position should always be taken where doubt exists and the case regarded as scarletina.

The period during which scarletina is infectious differs according to different observers. Most writers, however, agree in placing it from the first appearance of symptoms to the close of desquamation and until discharges cease. The contagion may remain potent in clothing for years.

The susceptibility of an individual to scarletina is much less as compared with small-pox and measles, about fifty per cent of the exposed contracting the disease. Opinions differ as to the respective susceptibility of the sexes, some authors stating that after the first two or three years females are more susceptible than males, but that the disease proves more fatal to males. The correctness of these statements, is, however, involved in much doubt. The disease seems to be more prevalent in the autumn and winter months.

As a sanitary precaution to be observed in all doubtful cases of sore throat with fever during epidemics of scarletina, the attack should be regarded with suspicion. The sufferer from scarletina should be isolated in a large, airy, light room from which all unnecessary articles of furniture, clothing, etc., have been removed. The word necessary in this connection should receive the most absolute interpretation implying there should only be left such articles as are indispensible to the welfare of the patient. All discharges from the nose, throat, eyes, ears, kidneys, bowels,

etc., should receive a thorough disinfection in solutions of chloride of lime, carbolic acid, formaldehyde or some equally efficient disinfectant. When practicable discharges should be received on rags and burned. Antiseptics should be used in the throat throughout the attack. Table cutlery, glasses, spoons, dishes, etc., should be thoroughly boiled. Bedding and clothing when possible should be put in some such solution as suggested above and boiled for at least twenty minutes. Strict quarantine measures should be observed and all to whom is granted the privilege of passing quarantine lines should be required to make complete change of clothing and wash hands and faces, including hair and beard, with carbolized soap. The quarantine period should last seven days from last exposure or during the entire infectious period as given above. Bland oils or fats and the bath are to be used in the period of desquamation to hasten the process and prevent distribution of the scales. The physician visiting these cases should be required to wear the cap and gown described on page 47. Following a siege of scarletina the most rigid room disinfection should be prosecuted after the manner described in the chapter on Room Disinfection, and in the event of death the antiseptic sheet, or the air-tight casket and the private funeral should be brought into service. The use of hacks as hearses should not be permitted. Immunity for life is usually a result of an attack of scarlatina.

Rubeola or Measles.

RUBEOLA OR MEASLES is an acute infectious disease characterized by fever, a peculiar eruption appearing on the skin and violent catarrhal symptoms prominent among which are sneezing, watering of the eyes, and a cough which is rather explosive in character. The specific cause like that of scarletina has not as yet been isolated but from analogy we again assume a germicidal origin exists in all cases and we manage it as a parasitic affection.

Measles also resembles scarletina in that it is usually classed as a disease of childhood. It differs, however, in two respects. Adults are more frequently attacked than is the case in scarletina and as a rule the affection seems to run a more violent course in adults than in children. It may be stated however that measles is not a common occurrence in children under six months of age.

The infectious principle whatever it may be seems to be given off from the skin and discharges from the nose, etc. It may be spread through the atmosphere for a short distance, hovering over the sufferer as a sort of effluvium and may be carried in the clothing although this latter mode of transmission is not so marked as in scarletina. Indeed it is probably very infrequent the disease is carried through the clothing on a third person. The infectious principle seems to be very diffusible and is of short life in which latter respect it again differs from that of scarletina.

Measles usually appears in an endemic or epidemic form, recurring in more or less regular

cycles of from two to seven years and is most common in the winter and spring months.

The period of incubation in measles varies from seven to eighteen days, the longest period recorded being eighteen days and the shortest at seven days. The average and most usual period of incubation is fourteen days.

The first symptoms to manifest themselves in measles are the fever and the catarrhal conditions, the eruption usually beginning at night and being discovered the fourth day from the onset. The eruption is not distinct when it first appears, the first appearance being on the mucous membrane of the mouth, on the forehead, the cheeks and the ears. It is of a macular (blotch) character, is elevated and ranges from a pale red to a deep red color. These blotches or macules are from a line to a quarter of an inch in diameter and in many cases seem to group themselves into crescentic figures. This grouping has been considered characteristic of measles. The order of appearance of the eruption has been variously given by different authors, most however, agreeing that it spreads from the face to the body on the second day and from the body to the extremities on the third day of the eruption.

Instead of the above mentioned grouping the eruption is sometimes found to be confluent in character. The eruption is most intense on the second or third day, dating from its appearance, and after this date begins to fade in the order of its appearance. As a rule the temperature will be found in a direct ratio to the rash. The disappearance of the eruption is complete usually in from four to six days from the appearance though occasionally there presents protracted cases in which it may last as long as ten or twelve

days. The desquamation is of a bran-like character and in some cases is so slight as to be scarcely noticeable. This process is usually complete in a very few days, but may be prolonged over a period of two weeks.

The diagnosis of measles depends on a history of exposure, slow onset, the catarrhal conditions and the characteristic eruption which has been described above. The diseases with which it is most likely to be confused in diagnosis are typhoid fever, typhus fever, scarlet fever, rubella, smallpox and chickenpox. In typhus and typhoid fevers is to be found markedly greater symptoms of depression than in measles and the catarrhal symptoms of the latter are absent. Scarletina was contrasted with measles in describing scarletina and the differential diagnosis need not be repeated. In both chickenpox and smallpox the eruption is of a papular character whilst as above stated it is of a macular character in measles. In none of the other eruptive diseases is there found so violent catarrhal symptoms. Rubella or rotheln is not so easily differentiated but the chief points of difference lie in the lower temperature of the latter (though it may be high) less violent catarrhal symptoms, eruption not grouped and not so distinctly macular, more sudden onset of rotheln and the heavily coated tongue of measles which is not found in rotheln.

Measles is infectious at all periods though least so during the stages of incubation and of desquamation. The disease is of so highly contagious a character that but few who are exposed escape an attack unless absolutely immune.

As a rule it may be stated that one attack confers immunity throughout life.

The sanitary measures to be observed are similar to those given under scarletina though from the fact the contagium does not cling so tenaciously to apartments, toys, etc., as in scarletina the room disinfection need not be such an exhaustive process. Usually a thorough cleaning using such methods as are commonly employed in house-cleaning is all that is necessary. Patients should of course be isolated in rooms prepared as for scarlet fever patients.

The period of quarantine should cover two or three weeks or according to Dr. J. N. Hurty, fifteen days from last exposure.

Rubella or False Measles.

RUBELLA, ROTHELN OR FALSE MEASLES is an acute infectious disease resembling both rubeola (measles) and scarlet fever and yet differing from them in important particulars. It is characterized by a fever of sudden onset, a maculo-papular eruption, mild catarrhal symptoms and a sore throat of moderate severity. In the matter of causation the disease occupies exactly the same position as do each of the other diseases that have been specially considered, i. e., nothing definite is known and yet from its phenomena there is a reasonable degree of assurance of germ origin. Most cases of rubella occur between the ages of four and fifteen years though adults are not infrequently affected. The disease resembles measles in that it occurs most frequently in the winter and spring months.

Opinions differ widely as to the degree of infectiousness of rubella which is probably high though somewhat less than that of scarletina and measles. The skin and breath seem to be the chief sources of the infectious agent which may be carried by means of bedding, clothing, toys, etc., but which does not apparently cling to these articles with the same tenacity found in the contagium of scarletina and diphtheria.

The infectious period extends from the earliest manifestation of symptoms throughout the entire course of the disease process including the stage of desquamation which phenomenon is of a branny or furfuraceous character frequently so slight as to be scarcely noticeable. The period of incubation is somewhat variable, this varience being characteristic of the disease, the range of varience being from one to three weeks.

There are but few prodromal symptoms in this affection the first indication of disease process being found in the slight elevation of temperature and the eruption which is usually discovered in the morning after having retired in apparently good health. The eruption appears first on the face but rapidly passes down over the chest, entire trunk and extremities so that in a few hours it has extended over the entire person. The duration of this eruption is short, lasting but three or four days, the rash and fever (which bears a close relation to the eruption) being at the acme by the second day. As before remarked the desquamation is but slight and is usually complete in from one to three days.

From its close resemblance in many particulars to measles and scarletina rubella has been a source of much annoyance to health officers and physicians, and indeed in many instances a differential diagnosis is next to impossible. Particularly is this true in differentiating from scarletina. The diagnosis depends on the suddenness of onset, there being but slight prodromes, if indeed any at all are noticed, absence of catarrhal symptoms, slight or irregular temperature and the following conditions compared with the symptoms of these other diseases. These comparisons are given not because of any great importance of rubella in and of itself but that the diagnosis is important that measles and scarletina may not be unrecognized and confused with the disease of less importance, thereby occasioning widespread epidemics of these affections which are of grave significance not only as dangerous and severe disease processes but as factors in important sequela.

The period of incubation is longer than that of scarletina whilst that of measles is almost univer-

sally fourteen days. The prodromal symptoms as stated above, if not absent entirely are but slight whilst in measles they last several days, consisting principally of the marked catarrhal symptoms. Sore throat is more frequent than is found in measles but is not so severe as usually attends scarletina. The fever in rubella is usually absent or slight but is marked and characteristic in both measles and scarletina.

The eruption of scarletina first appears on the neck and chest and spreads slowly. In measles and rubella the first appearance is on the face spreading gradually in measles and rapidly in rubella covering the entire body in twenty-four hours. The color of the eruption is a pale red, lighter than in measles or scarletina and is not so elevated as in either of these affections. Neither is any grouping to be found. The tongue of rubella is usually but slightly coated, that of measles heavily coated and that of scarletina showing an elevation of papilla which gives to it the name of strawberry tongue. Albumen is frequently found in the urine in cases of scarletina. This is sometimes the case in measles, but almost never true in rubella. In the last stage, that of desquamation there is another point of difference. In measles it is of a branny character; in rubella slight, absent or branny and in scarletina in larger flakes.

The contagium of rubella does not cling to apartments with the same tenacity of that of scarlet fever but owing to possibility of confusion and error the same methods of disinfection should be employed. Quarantine should cover a period of about two weeks. As with the other acute eruptive diseases one attack seems to render immunity for life.

Parotiditis.

EPIDEMIC PAROTIDITIS OR MUMPS.—This disease is an acute infectious affection characterized by a chill, fever, headache and inflamed state of the parotid or other salivary glands. Usually, however, one or both parotids is the site of the inflammation. Under two years the disease is of rare occurrence, being found most commonly between the ages of five and fifteen years. The affection seems to prevail as an endemic or epidemic and is unquestionably of an infectious origin though no organism has been demonstrated to be the specific cause. The contagium is most probably conveyed through personal proximity (not necessarily contact) by means of the breath — possibly through the clothing at times though rarely so.

The period of incubation varies from one to three weeks, the shortest time reported being three days, the longest six weeks and the average three weeks. The swelling of the glands is usually preceded by a feeling of malaise, headache, chilliness, fever and occasionally severe neuralgic pains. The swelling as a rule involves only the parotid glands, but anomalous cases arise in which the submaxillary or sublingual glands are alone affected or even the testes to which organs the disease shows a marked tendency to metastatic change. One gland usually precedes the other in the disease process and in some cases one gland alone is affected though both may suffer at the same time. In cases where the disease process is unilateral a second attack involving the other gland may occur at

any time. The swelling of the glands is usually at the maximum in from two to four days and continues from seven to ten days in cases not complicated with metastasis.

The infectious period probably covers the entire course of the disease including the period of incubation and for several days following the disappearance of the swelling. The affection is undoubtedly infectious from the beginning of symptoms. Quarantine should cover the infectious period and as a sanitary measure the patient should be isolated during this time. The contagium seems to possess such a short life that fumigation is considered unnecessary.

Variola.

VARIOLA OR SMALLPOX is an acute, highly infectious disease characterized by chill, fever, severe pain in the back, sore throat, extreme prostration and a peculiar eruption which usually makes its appearance in from two to four days from the beginning of symptoms. Variola always proceeds directly or indirectly from a previous case though the exact nature of the contagium is not known.

Age as a factor in susceptibility is not an important consideration in smallpox save as is apparent from the fact one attack almost without exception immunizes from future attacks for all time. Racial differences, however, seem to be of somewhat greater importance in the consideration of susceptibility, the dark skinned races being more susceptible than those of lighter hue. Vaccination likewise influences susceptibility. This phase will be considered later. The lessened susceptibility from vaccination however is not necessarily permanent but disappears in time. The contagion of variola is quite virulent under favorable conditions living as long as two or more years. The agent resists drying to a remarkable degree, a factor which greatly facilitates the clinging to articles of clothing or furniture and its distribution in the form of dust particles in the atmosphere. The infectious agent which is given off freely from the sufferer is usually conveyed by means of the air, clothing, bedding, personal contact, sputa, excreta from the skin, nose, etc., but is soon destroyed in the presence

of air and bright sunlight. The usual avenue of entrance to the system is the repiratory tract.

The period of incubation is usually placed at ten or twelve days. The shortest period on record is eight days and the longest fifteen days, the average being twelve.

The eruption first appears on the forehead, temple and wrists and is to be found from the second to the fourth day of the disease dating from the beginning of symptoms as stated above. This eruption in the course of the disease passes through a series of changes this successive change being characteristic of the affection and one of the diagnostic features. The eruption appears to manifest a preference for exposed surfaces. The first appearance of the eruption is deep down in the skin and presents a hard, sort of shotty feeling. There is at first but little elevation above the surrounding healthy skin but by the third day these points have become elevated, passing through a papular stage and at this time being crowned with minute little blisters or vesicles which are filled with a straw colored fluid. These blisters or vesicles as they are more properly called soon become depressed in the center and are then said to have become umbilicated. In the few succeeding days the serum becomes somewhat clouded and the vesicles degenerate into pustules beginning by the eleventh or twelfth day the process of desiccation or drying up. After the healing process is complete the scabs drop off and the skin presents a red mottled appearance which gradually fades leaving a healthy appearing skin or the scar.

Since in the eruptive stage of variola there is a destruction of tissue it necessarily follows that

Figure XXXII.

Variola.

those dying of smallpox must show the presence of these papules, vesicles, or pustules, minus of course a certain amount of color due to the absence of the blood.

To diagnose smallpox one must depend on the above mentioned characteristic symptoms, a history of exposure and no history or evidence of a recent or successful vaccination.

Authors differ as to just the extent of the period of infection. The disease is certainly most infectious during the period of vesicular and pustular eruption and during dessication and dropping off of the scabs. To be on the safe side however one should regard the period of infection as beginning with the first manifestation of symptoms and closing with a healthy skin and proper disinfection.

The sanitary measures which should be required consist in prompt isolation and strict quarantine covering the entire period of incubation and infection, absolute cleanliness, disinfectant washes for discharges of nose, eyes, mouth, etc., carbolized oil or vaseline for scaling off period, the most rigid room and personal disinfection as set forth on pages 43 and 62, the most rigid enforcement of sanitary rules in preparation of the corpse in infectious cases (see Chapter VII) and vaccination and revaccination. The patient should be given antiseptic baths and all clothing, etc., should be properly disinfected, boiling when possible in antiseptic solutions. The period of quarantine should extend to fifteen days from last exposure or should cover the entire infectious period. One attack usually confers immunity for life although there may be exceptions to this rule.

Varioloid.

VARIOLOID is a modified form of smallpox occurring in individuals who have been vaccinated successfully, not as a result of the vaccination but as the result of an exposure to smallpox, the vaccination occupying only a modifying not a causative relation in any instance. The disease is mild in its manifestations but should receive careful and rigid sanitary considerations since the differential diagnosis is not always easy and since above all other reasons from this mild form of the affection known as varioloid a true case of smallpox (variola vera) may result. All that has been said relative to the sanitary measures and precautions to be observed in dealing with smallpox applies therefore with equal force in varioloid.

Bodies dead from smallpox or varioloid are potent factors in disseminating the disease and should therefore be thoroughly disinfected by proper embalmment and thorough soaking in an antiseptic solution, for which purpose there is probably nothing superior to bichloride of mercury in the proportion of one ounce to the gallon of water or five ounces of chloride of lime in one gallon of water used on a heavy layer of absorbent cotton. In all cases the body should be wrapped in the antiseptic sheet or blanket observing great care that the work is done thoroughly.

Vaccinia.

VACCINIA is an inoculable disease transmitted in no way save by inoculation and characterized by fever, pain and the formation of a pustule which has passed through a papular and vesicular stage. These pustules occur at each point of inoculation. The course of vaccinia is remarkably regular when uncomplicated by mixed infection or impure virus. In vaccinia is found our most efficient means of prophylaxis against smallpox.

The complete history of vaccination as a prevention of smallpox is too voluminous to be given. Suffice it to say the first practical demonstration of method — much the same as at present though improvements have been added — and efficiency was made by Jenner in May, 1796. No germ has been isolated and proven to be the cause of vaccinia but that such an organism exists seems more than probable. The discovery of the efficiency was purely a matter of observation. Dairy hands contracted an affection (vaccinia) from cows suffering from what is known as cow-pox. Later it was observed those who had been so affected possessed a relative degree almost an absolute degree of immunity from smallpox and from this observation the present system of vaccination against smallpox has developed. There are those who believe and advocate that cow-pox is smallpox in the bovine, whilst others claim it is quite a different disease. Acting on the first theory certain scientists have modified smallpox by passing its virus through bovine animals, a process which seems to lower its potency, and

from the virus thus obtained have successfully vaccinated against smallpox. Others have not failed in the desired end of an immunity against smallpox, but unfortunately have attained such immunity by inducing the true smallpox through an inoculation with such modified (?) virus. The safe plan is to use no such virus until thoroughly tested and proven to be identical with true vaccinia of the heifer.

No symptoms are manifest for the first few days following a vaccination (which should be from a sealed tube of sterile virus) other than those attendant on a slight abrasion of the skin. By the third or fourth day a slight redness is discernible at the point at which the virus was introduced. This redness gradually increases and a papule is formed which by the fifth day should begin to be vesicular. By the eighth day the vesicle should have become mature and should be umbilicated as are the vesicles of smallpox. Desiccation then begins and by the end of the second week there is usually a perfectly dry scab which however may not drop off for another week or even longer. The scar is frequently pitted.

The dangers of vaccination have been heralded widely but as a matter of fact where pure virus is used, care being taken to prevent a mixed infection, the danger of inducing any other disease than vaccinia which is sought is practically nil. In a somewhat extended experience I have never found a case in which the symptoms of vaccinia were at all alarming notwithstanding the fact cases have been under observation including both extremes of age. Cases have been reported where arms and life were in danger but on investigation I have found the danger to exist chiefly in an

over-wrought state of the patient's nerves. I doubt not the reliability of certain reported cases in which life or limb or both have been sacrificed but in such instances if one could only get at the facts I am convinced the fault lies either in impure virus, faulty methods of operating or carelessness in the after treatment. A vaccination is a surgical operation and should be treated as such, all precautions of asepsis being observed both at the time of operation and in the necessary care to follow. Any one who fails to recognize these facts and to act accordingly should not assume the responsibility of the operation. Human virus i. e. virus taken from another patient's arm or scab should not be used. Cleanliness is the essential sanitary precaution to be employed and when pure virus is used and surgical cleanliness observed throughout the entire course I have no hesitancy in stating there is no danger. Even when the ordinary methods and care are employed the dangers are in no degree comparable with those of smallpox.

Varicella or Chickenpox.

VARICELLA OR CHICKENPOX is a disease heretofore considered of little significance owing to the mild train of symptoms usually manifest. Of later years though the affection has come to demand more attention owing to the occasional severity of symptoms and the frequency with which it is confused with smallpox. Varicella is characterized by a short fever of a mild type accompanied by an eruption appearing in a succession of crops, the eruption being of a vesicular type. Varicella stands in the same class as measles and other eruptive diseases that have been considered, as regards causation no specific agent having been positively identified and yet the course of the disease being such as to confirm one in the belief of a parasitic origin. Most cases of chickenpox occur between the ages of one and ten years, often the disease being found in children under six months of age and occasionally an adult being affected. After ten years of age the susceptibility seems to lessen somewhat, but notwithstanding this fact and that one attack usually confers immunity for life in rare instances an individual suffers from a subsequent attack. In these cases of subsequent attacks of varicella the symptoms are frequently so mild as to not attract much attention. However, this may quite as truthfully be said of many of the primary cases.

Two or more weeks is the usual period of incubation, the shortest period coming within my knowledge being thirteen days and the longest nineteen days. Fourteen days constitute the average duration of incubation.

The eruption which is frequently the first symptom appears in the form of a macule, but

soon changes to a vesicle or blister. The contents of this vesicle, a clear serum, is soon observed to become clouded or milky though it is never of so distinctly purulent a type as is found in the pustules of variola vera (smallpox). There is a gangrenous form of the disease however in which a part of the vesicles degenerate into deep phagedenic ulcers extending down even through the skin and sometimes involving muscular tissue. The average size of the vesicles in an ordinary case of chickenpox is about one-eighth of an inch or equal to a split pea. The eruption of chickenpox appears in a succession of crops and not simultaneously as in smallpox, this being one of the characteristic symptoms. Some vesicles have begun to dry when others are but appearing in the macular stage. In fact all stages of the eruption are to be found at one time in the same case. There is no umbilication in the eruption of varicella, such as is found in the eruption of smallpox. There is though a sort of depression found in the vesicle in the stage of desiccation, but this depression is due to the drying and not to any binding down by means of bands of connective tissue as in smallpox. The eruption occasionally appears on the mucous membrane of the mouth and of the genitalia, but never on the conjunctiva and seldom or never on the palms of the hand or soles of the feet.

A differential diagnosis from variola is to be made and depends on the above phenomena and the following distinctive symptoms. In smallpox as before mentioned the eruption has a hard shotty feel, even before it has thoroughly appeared on the surface. This hard shotty sensation to the touch is not to be found in varicella as a rule. The severe pain in the back found in smallpox is wanting in chickenpox. There is in

this latter affection usually an absence of the severe constitutional disturbances of smallpox. Next to be considered or perhaps I had better say the first consideration in differentiating between smallpox and chickenpox is the history of the case and presence or absence of evidence of a successful vaccination, since vaccination renders a comparative immunity from smallpox. In chickenpox the eruption is greatest in those parts of the body covered with clothing whilst in smallpox the exposed parts i. e. the face and hands are most affected. The eruption of smallpox reaches a pustular stage. That of chickenpox does not. In smallpox the eruption is also slower in its development and spreading never appearing in a succession of crops such as is found in chickenpox. The eruption of smallpox is likewise more uniform in size.

Varicella or chickenpox is highly contagious from the earliest manifestation of the eruption until it has completely disappeared. This entire period of infectiousness should be under quarantine restrictions. Where one is held in quarantine in the expectancy of an attack following exposure the quarantine restrictions should be removed in nineteen days from the last exposure. As stated above one attack usually confers immunity. Where death occurs, as it sometimes does in the gangrenous form of the disease, the corpse is necessarily marked since there is in the vesicle a certain amount of tissue destruction. There is no special form of treatment required in these cases other than an application of the rules of sanitation which apply to the communicable diseases in common including prompt burial and the antiseptic sheet in all cases where the diagnosis is at all a doubtful question.

Pertussis or Whooping Cough.

PERTUSSIS OR WHOOPING COUGH is an acute infectious disease characterized by bronchial, laryngial and nasal catarrh and a paroxysmal cough. Most cases occur within the first six years of life and of these more than fifty per cent before the fourth year. Cases occurring before the sixth month are not uncommon. The affection is not often met after the tenth year though occasionally a case is found in the adult. Two reasons may be assigned for the above facts regarding the age of patients affected. First, most children are exposed before the sixth year and second, susceptibility seems to lessen after the tenth year. Although a matter of some doubt the causative agent is again presumed to be microbic in character, the disease process so closely conforming to other disease processes known to be of bacterial origin. The bacillus tussus convulsivae has been assigned as its cause but is somewhat lacking in proof. The agent is transmitted from the respiratory tract by means of the breath and the secretions of the mucous lining of the respiratory passages. A rather close contact seems to be essential though this need be only for a comparatively short time. In rare instances the infection may have been carried on clothing though this is unusual.

The diagnosis of whooping cough is dependent largely on a history of exposure and the presence of a markedly paroxysmal cough, the paroxysms not infrequently lasting for several minutes and being so severe as to occasion a rupture of small blood vessels in the mucous membrane of the

nose or eye. The cough is characterized by a sort of whistling sound on inspiration which sound has given the affection the name whooping cough. Pertussus is infectious during the entire period of catarrhal symptoms, lasting in ordinary cases from six to eight weeks.

Various estimates have been placed on the period of incubation ranging from two to twenty-one days. The average term of incubation, however, is from three to seven days. In all cases the quarantine should be maintained throughout the entire infectious period and some even urge its continuance until all cough has ceased even if it should return. The patient should be isolated and following the attack the rooms occupied should be disinfected according to the general rules for room disinfection. The disease is more dangerous than is generally supposed and for some unaccountable reason more fatal to Negroes than others. One attack usually confers immunity.

Diphtheria.

DIPHTHERIA is an acute, highly infectious disease characterized by fever, prostration and a sore throat in which is found a grayish white exudate or pseudo membrane. The disease may be endemic or epidemic and occasionally a sporadic case is found. The origin is unquestionably a micro-organism, the Klebs-Loeffler bacillus having been demonstrated to be the specific cause of the affection. Diphtheria is usually classed with the eruptive diseases notwithstanding the fact there is no eruption. There is however a local manifestation and constitu-

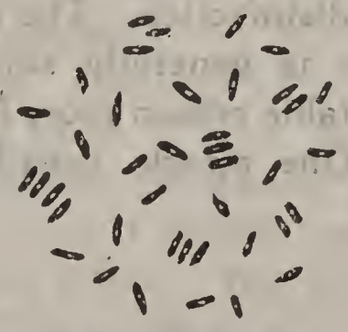


Figure XXXIII.
Bacillus diphtheria.

tional disturbance. The morphology and staining methods of the bacillus diphtheria are not essential in this connection since they are found in any standard work on bacteriology. Suffice it to say in relation to this organism that a low temperature, moist air and darkness seem to protect the life of the organism and hence diphtheria is more common in the spring and winter months. For obvious reasons cellars and basements are favorable to the disease.

Sex does not seem to be an important consideration in diphtheria, the sexes being attacked

with about equal frequency. Most cases occur before the age of fifteen, although cases are by no means infrequent after this age and in fact even in adult life.

It will be readily understood from what has been said above that no case of diphtheria can arise de novo. If the complete history could always be ascertained one might in every instance be able to trace infection to a previous case of diphtheria. Cases of apparently simple tonsilitis, nasal ulceration or ozena are not infrequently diphtheritic in character and furnish the required infective agent. Cats, pigeons and fowls suffer from throat affections of a diphtheritic character and are doubtless frequent factors in the spread of diphtheria. But recently four cases, one of which was fatal, came under my observation in which the infection was traceable to a dog. Another manner of spreading the infection of diphtheria is through milk which has been infected from affected persons employed in the cow-sheds, dairies, etc. Fomites, i. e., bedding, clothing, carpets, books, toys, spoons, forks, etc., constitute another source of infection which is most potent. From this statement it will be seen diphtheria may also be contracted from a person who has been in contact with a case of diphtheria who has not himself contracted the disease. In this manner physicians have carried the disease from house to house in making their rounds, little or no attention having been given to personal disinfection as outlined in chapter five. It is needless to add such a practice is nothing short of inhuman if not criminal. Defective sanitary conditions may be mentioned as a predisposing factor in the causation of diphtheria acting as such by engendering morbid conditions of the upper respiratory

passages favorable to the growth of the diphtheria organisms when implanted thereon.

The period of incubation has a very considerable range of variance extending from an indefinitely short period up to seven days the average term being two days.

The diagnosis of diphtheria though of inestimable importance and a matter which may be made an absolute certainty is frequently in doubt. The points on which certainty of diagnosis depends are a history of exposure, the presence of grayish white adherent patches of a pseudo membrane in any part of the upper respiratory passages, (particularly other parts than on the tonsils) and in chief the presence of the bacillus of diphtheria as shown by the microscope. This latter is the positive diagnostic feature. The membrane above mentioned is composed of partially organized lymph and necrotic epithelial tissue.

Throughout the entire course from the first manifestation of symptoms (perhaps from first exposure) till the bacilli have disappeared from the throat diphtheria is contagious. By some it is even supposed to be contagious during the incubative period. This period during which the infectious agents may be given off may cover as much as six or eight weeks, dating from the beginning of the attack.

Susceptibility seems to lessen somewhat after the fifteenth year of age and for some months after an attack. The most rigid sanitary measures are to be enforced in dealing with diphtheria. Complete isolation of the patient is the first consideration and this isolation should continue throughout the entire period of infectiousness. The mouth, nose and throat not only of patient but of any one who has been exposed should be

cleansed thoroughly and at frequent intervals for which purpose should be used an antiseptic wash or spray such as may be prepared from Dr. Seiler's alkaline and antiseptic tablets or a saturated solution of boracic acid. The granular form of the acid is to be preferred for this use since it forms solutions much more readily than the powdered form. Immunizing doses of antitoxine should be used. Glasses, spoons, cups, knives, forks, plates and all other such articles used by the patients should be thoroughly boiled or otherwise disinfected before being used again. There should be no eating or drinking in the room occupied by the patient. The personal disinfection should be the most rigid, as before outlined, and should be required of all quitting the room. Discharges from the nose and mouth should be received in cloths or rags which should be burned at once. All clothing, bedding, towels and similar articles should be immersed in antiseptic solutions before removal from the sick room. A strong solution of chloride of lime or a carbolic solution of four per cent answers admirably for this purpose. Later these articles should be boiled for not less than thirty to forty minutes. Discharges from the rectum or bladder should be received in a strong solution of chloride of lime or formaldehyde. A strict watch should be observed, particularly where the patient can not be isolated.

Subsequent to diphtheria the room, clothing and other infected articles should receive a most careful disinfection after the manner outlined in the chapter on room disinfection. Directions for a sanitary funeral have also been outlined and need not to be repeated. The person in charge should however keep in mind that too much precaution can not be taken in these matters and

where any doubt exists nothing of a prophylactic nature should be left undone.

The quarantine restrictions should be in force from exposure until the microscope shows the throat to be free from the organisms and until proper disinfection has been secured.

One attack does not afford protection against subsequent attacks though it does probably lessen susceptibility to a degree for some months. In discussing this point, however, L. E. Holt, (N. Y.) says: "Second attacks of diphtheria, while more frequent than those of measles or scarlet fever, are relatively rare. In my own experience, however, I can recall but very few instances of second attacks. R. W. Parker, (London) believes the protection afforded by one attack to be quite as complete as that of measles or scarlet fever."

"MEMBRANOUS CROUP," quoting from the Indiana State Board of Health, "is diphtheria of the larynx, is more fatal than ordinary diphtheria and requires extraordinary care."

Typhus Fever

TYPHUS FEVER, hospital fever, ship fever or jail fever, also known by several other names, is an acute infectious disease characterized by sudden onset, fever, a macular rash, pronounced nervous manifestations and a crisis. The affection is acompanied by great prostration and is regarded as highly contagious. Notwithstanding the violent course of clinical phenomena on post-mortem examination are found no special lesions other than a general hyperaemic condition of the viscera and a softened, degenerated heart structure. The disease has not been of frequent occurrence of late years but is sometimes found in densely populated districts.

The specific cause of typhus fever is undoubtedly a micro-organism although it has not as yet been identified. Filth, bad food, overcrowding, intemperance and fear act as predisposing causes. Strange as it may seem fear is an important consideration in the susceptibility of an individual to any disease process. I can only account for this fact on the theory that fear is depressing and hence lessens the resisting powers of an individual.

The disease is but seldom found in one under ten years of age or over sixty-five and where found under ten years the process is usually mild and rarely fatal. The contagion of typhus fever is given off from the respiratory passages and as a sort of effluvium from the body much the same as in measles. The intestinal discharges are thought by some to be infectious. Apartments, clothing, etc., may become infected though the

infection must be profound to be transmitted by means of fomites. A direct contact, however, is not essential, simply being in the presence of the disease often being sufficient for a transmission. The period of incubation is usually estimated at from eight to twelve days though a few have placed it as low as one day or even less.

As stated above the eruption of typhus fever is macular in character. It usually appears on the fourth day but may be as late as the sixth or seventh and lasts from one to two weeks. The chest and abdomen first show the eruption being followed by the arms and thighs, the face and neck not often being involved. In appearance the eruption resembles most that of measles and sometimes even presents the grouping found in the latter affection. In measles, however, the face and neck are early involved and are distinctly covered with the macules. The eruption does not appear in successive crops as in typhoid fever. True petechia representing subcutaneous ecchymoses appear and can not of course be effaced by pressure.

The eruption is one of the chief symptoms on which reliance is to be placed in making a diagnosis. The affection must be differentiated from typhoid fever, meningitis and measles with which affections it may be confused. The temperature of typhus fever does not present the wave line usually present in typhoid fever. Neither do we find the abdominal symptoms characteristic of the latter affection. The eruption does not appear in successive crops as in typhoid and is of a more distinct and lasting type than is found in typhoid. Epistaxis may be found in either affection though it is usually suggestive of typhoid rather than typhus. In differentiating from measles age and

the catarrhal symptoms are the chief points to be taken into account other than the usual absence of eruption from the face and neck in typhus fever. Meningitis and typhus fever are more likely to be confused. In meningitis, however, the cerebral symptoms are earlier and more marked while in typhus the muscular rigidity of meningitis is wanting The hyperaesthesia is not so marked in typhus fever but the temperature runs a higher course

The disease is probably not infectious till the end of the first week but this is not a well established fact and is therefore a theory on which it is not safe to rely. There is also some question as to the power of a body dead of typhus fever (not typhoid fever) to supply infection but since this too is not a known fact and since there is no good reason why such a corpse should not be disinfected it should be regarded as infectious. The safe view of the period of infection then is that it covers the entire period of the disease which is usually two or three weeks and that quarantine measures should be enforced throughout this period and until proper disinfection has been accomplished.

The sanitary measures to be observed are quarantine, isolation of patient, and room and corpse disinfection as outlined previously.

In regard to immunity second and third attacks do occur but are not frequent.

Typhoid Fever.

TYPHOID FEVER or enteric fever is an acute disease characterized by a tumefaction and ulceration of the lymph follicles of the intestinal tract, inflammation of the mesenteric glands, profound prostration, fever, eruption, tympanites and abdominal tenderness particularly over the right iliac region. The sanitary features of typhoid are so extended they must be mentioned only in outline. Typhoid is peculiarly a disease of temperate climates and prevails in the autumn months, a hot dry season favoring its development. Heavy rains, however, may be an important factor in carrying the infection into new

Figure XXXIV.
Bacillus Typhosus. — Lower segment showing flagella through special staining of Loffler.

fields. From a sanitary point of view sex is not so important an element of consideration as age, the sexes being about equally susceptible. Infants and adults over fifty-five or sixty years of age are but seldom affected.

Typhoid is practically never transmitted through the atmosphere, the usual source of infection being contaminated water or food, particularly water. Flies may be carriers of infection from the sick room to food or water. Oysters fattened in water contaminated with sewage are

said to be a potent factor in the dissemination of typhoid. Typhoid is recognized as a disease of filth, bad sewers and accumulations of putrefactive material favoring the growth and spread of the infective agents. The specific cause of typhoid fever is a micro-organism known as the bacillus typhosus.

The period of incubation usually lasting some two or three weeks is characterized by a sense of languor or malaise. The shortest period of incubation reported is seven days, the longest twenty-three days and the average usually being placed at twelve or fourteen days.

The eruption of typhoid fever varies widely in different cases. It may consist of only a few scarcely noticeable spots or may be profuse even rivaling that of measles or it may occupy any intermediate station between these extremes. The usual eruption, however, is quite insignificant and often overlooked. It is a rose colored rash which makes its appearance toward the end of the first week. It appears in a succession of crops.

The diagnosis of typhoid fever during epidemics is comparatively easy, depending on history of exposure, malaise, characteristic temperature curve, tenderness in right iliac region, diarrhoea, rash, tympanites, odor, prostration, delirium, etc. In isolated cases the diagnosis is more of a problem and if one depends wholly on the clinical picture can not usually be made with certainty under from five to seven days. The chief confusion is with malarial infections. A blood examination and the microscope usually are conclusive even in cases where the clinical picture is not decisive.

The contagious period covers the entire course of the disease which is from three weeks to an

indefinite time depending on the severity of the attack, the number of relapses, etc.

Sanitary precautions are numerous. Rubber coverings for the mattress are very desirable, almost essential to protect from discharges. A daily change of bed linen and clothing, oftener if soiled, is of prime importance. In handling these articles they should be placed in a strong antiseptic solution before removing from the room as provided in discussing diphtheria. All feeding utensils and similar articles should be thoroughly boiled before using again. Discharges from the rectum or bladder should be received in an antiseptic solution and should remain in this solution for at least one hour after thorough mixing. Body and room disinfection as before provided should be employed. It is not necessary ordinarily in these cases to employ the antiseptic sheet in which to wrap the body but the orifices, particularly the rectum, should be closed and the body should be thoroughly washed in a strong antiseptic solution. Those nursing patients suffering from typhoid fever or handling the infected clothing, or bodies dead from typhoid should never put the hands to the mouth without a previous careful disinfection. The infection of typhoid fever is taken into the system in all instances through the alimentary tract.

Carbolic acid, bichloride of mercury, chlorine (chloride of lime) and formaldehyde form a list of most desirable disinfectants in typhoid cases.

Quarantine should include the entire period of infectiousness when employed though usually quarantine measures are very lax if employed at all.

One attack usually confers immunity though there are exceptions to this rule.

Cerebro-Spinal Meningitis.

EPIDEMIC CEREBRO-SPINAL MENINGITIS OR SPOTTED FEVER is an acute infectious disease characterized by an inflammation of the membranous inner coverings of the brain and spinal cord, the clinical picture presenting marked disturbance of the cerebro-spinal functions with a tendency to speedy death. Like most of the foregoing affections no specific micro-organism has been demonstrated to be the exciting cause of spotted fever and yet through analogy we again assume that such a cause exists. Indeed different organisms have been assigned as the cause, but authors and investigators do not fully agree as to any one or group

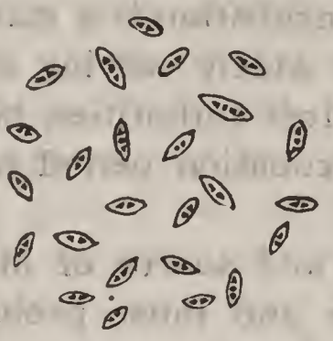


Figure XXXV.
Micrococcus Lanceolatus Encapsulatus.

and no one answers to all the various laws of proof as given in Chapter I. The micrococcus of lanceolatus encapsulatus is universally present in these cases but is also found in healthy individuals. This fact does not necessarily imply it may not be the specific cause of the disease, however, and indeed it is most probable the above germ is responsible for the disease process, the fact that some individuals contract the affection and others do not being accounted for in a dif-

ference of resisting power. All influences that tend to a lowered vitality and resisting power including fatigue, over-crowding, foul water, exposure to cold, moisture and like agencies may be listed as predisposing causes. The prevalence of these above mentioned conditions doubtless accounts for the epidemic feature of the disease.

Most cases occur before the fifth year and in the first year the disease seems to be markedly more fatal. Doubtless this greater mortality rate of the first year is due to the feeble powers of resistance of this period. In the adult males are more frequently affected than females. This difference is probably due in some measure to greater exposure of males.

The clinical picture is not at all uniform in all cases, the eruption sometimes not appearing at all and in some cases extravasations occurring. The period of incubation is a matter of some uncertainty many widely varying estimates having been placed. Most authorities, however, seem to agree on an incubation period of from eight to ten days.

The manner and source of infection are also quite indefinite and must probably remain so since the most probable causative agent is so frequently found in healthy individuals. The diagnosis of spotted fever is essentially a matter of close observation depending on the suddenness of attack, vomiting, pain, the eruption, muscular rigidity and prominent cerebro-spinal symptoms.

The disease is probably not so highly contagious as at one time supposed and isolation of the patient with good ventilation are practically the only sanitary precautions essential.

Immunity does not necessarily follow.

Erysipelas.

ERYSIPELAS, ROSE or St. Anthony's Fire is an acute infectious disease characterized by a violent inflammation of the skin with fever and a general constitutional disturbance. A micro-organism known as the streptococcus erysipelatos is the specific cause of erysipelas (see figure IV). As predisposing or contributory factors may be mentioned again any thing that will exhaust energy including alcoholic indulgence, and exposure. Wounds of the skin or mucous membranes are important factors in the causation of erysipelas since they furnish ready avenues of entrance for the bacteria. The disease process may be established however without any apparent abrasion owing to a diminished resisting power of the skin. In such cases though there is always the possibility of abrasions that are so insignificant as to have been overlooked. A moist atmosphere and a comparatively low temperature are favorable to the growth and development of the organisms which occasion erysipelas, but in the dry form they retain their vitality for long periods of time — even for years — and may be carried as dust particles for a considerable distance in the air and on clothing, no doubt in this manner occasioning more or less widespread epidemics of erysipelas in hospitals. A direct contact or an indirect contact by means of an operator's hands may also be a means of transmission.

Erysipelas is usually found affecting individuals of early adult life and seems to be slightly more frequent in males than in females. This predilection for males is doubtless due to the greater exposure and more common indulgence of males in alcoholics.

Incubation is again a matter of considerable uncertainty varying from one to fourteen days. The eruption is an early symptom and ranges from the blush of pink to a deep red. There is a tendency to spread rapidly. The color may be effaced by pressure but returns immediately on removal of the pressure. The skin is hot and tumefied owing to an infiltration of the subcutaneous tissue which is also involved in the inflammatory process. The margins of the affected area are usually well defined. The duration of erysipelas is variable, lasting from a few days to weeks. As a rule it may be stated improvement is not to be expected under five days.

The diagnosis of erysipelas is to be made through the microscope and from the clinical picture presenting the above described local conditions, heavily coated tongue, headache, chill, fever and frequently a sore throat.

Erysipelas is communicable throughout the entire course of the disease. Susceptibility seems to increase with each attack rather than to diminish. Many different varieties of erysipelas have been named, particularly among the laity, but all are erysipelas and differ more in degree than in quality and all are no doubt due to the same specific cause.

The sanitary precautions to be observed call for isolation of the patient (particularly is this essential in hospital cases), personal disinfection of nurses, physicians and all connected with the case, clothing and bedding to be placed in antiseptic solutions before being removed from the bed chamber, infected dressings to be burned and a thorough disinfection of furniture and room according to methods before outlined.

Syphilis.

SYPHILIS OR POX is an infectious disease pursuing a very chronic, irregular course, characterized in acquired cases by an initial ulcer followed by varying eruptions and organic disease of almost every organ of the body.

If we may judge by analogy syphilis is most probably of bacterial origin for like diseases known to be due to bacterial invasion the affection presents stages of incubation, aggression, decline and immunity. The exact micro-organism occasioning syphilis has however not as yet been demonstrated.

Syphilis may be either inherited or acquired, inherited syphilis manifesting itself in developmental changes of structure and lowered vitality and the usual symptoms of syphilis to be found in the tertiary stage. Very possibly many of these cases have acquired syphilis while in utero. Paternal syphilis is, however, frequently manifest in the child. Acquired syphilis is usually of a direct venerial origin though infection may and doubtless does frequently occur in other manner. For example the hand of the physician, surgeon or embalmer (though some contend a body dead of syphilis will not infect) may be inoculated while engaged in the performance of his professional duties. Dental instruments may be agents in the spread of syphilis as may public drinking vessels; or the disease may be transmitted through kissing. Pipes have been agents of transmission. In short any means by which infected blood or syphilitic virus may be carried to an abraded skin

or mucous membrane may be a source of infection.

Incubation is usually a matter of about three weeks from infection to the appearance of the initial ulcer though it sometimes is as short as ten days or may be prolonged for three months. The ulcer which lasts from two to twelve weeks is followed by eruptions which vary from macules to papules and pustules. This period of eruption in which the mucous membranes and frequently the hair are involved also is known as the secondary stage. This stage is preceded by what is known as the period of secondary incubation which is usually of about six weeks duration including the period of primary ulcer above given. The secondary period or stage lasts from a year to two years and is usually followed by a period of quiescence lasting from two to four years. The tertiary period which follows is of indefinite duration. The tertiary period is characterized by organic disease of the bones, vessels, viscera and skin and is regarded by most authors as noninfectious.

The diagnosis of syphilis at present depends entirely on the history of exposure, the clinical picture as presented above and a tolerance for certain lines of treatment. The initial ulcer of syphilis is non-phagedenic and is indurated in contradistinction from the chancroid commonly spoken of as soft chancre which is purely a local disease of minor importance. In the late stages of syphilis diagnosis depends much on the history, enlarged glands and scars.

Syphilis is unquestionably communicable in the first and second stages, possibly so in the third though most writers agree that in the third stage the disease is noncommunicable. The con-

tagion is to be found in the blood during the secondary stage and in the secretion of the chancre (initial lesion) or of the secondary lesions.

The sanitary precautions and regulations of syphilis are a very perplexing problem. It is a matter hard to regulate. One can do little more than advise. Quarantine is practically out of the question. Licensed prostitution on a basis of health certificates has been tried with but little success. Probably the greatest protection is to be found in education, moral as well as intellectual. The infected dressings and utensils should be disinfected by means of the stronger antiseptics, fire or boiling. The syphilitic should certainly not be permitted to marry for at least two or three years after contracting the disease and then not unless persistent intelligent treatment has been pursued throughout the entire course of disease; certainly not unless there has been no syphilitic outbreak for from six months to a year.

Gonorrhoea.

GONORRHOEA OR SPECIFIC URETHRITIS is an acute infectious disease characterized by an inflammation of the urethra. The specific cause of gonorrhoea is the micrococcus gonorrhoea, the usual source of infection being venereal. In the female subject in addition to the urethra the labia, vagina and frequently the mucous lining of the uterus and Fallopian tubes are also involved.

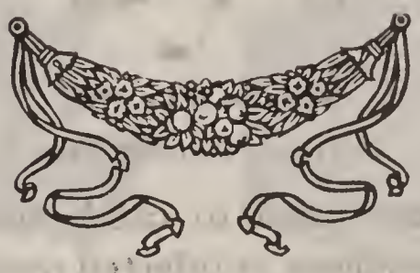
Incubation lasts from two to ten days, the early symptoms being pain on urination and a burning sensation. There is soon a discharge of yellowish green pus. The diagnosis is made from the above symptoms, a history of exposure and by means of the microscope.

Figure XXXVI.

Gonococci.

Gonorrhoea is contagious so long as the microorganisms are present. This may or may not be throughout the entire course of the disease but always last throughout the acute period which is of indefinite duration. In all cases where the microscope is not brought into use gonorrhoea should be regarded as transmissible until all discharge has ceased.

What has been said of quarantine and restrictive measures in the consideration of syphilis applies with equal force to gonorrhoea. Soiled dressings should be burned or disinfected with moist heat or powerful antiseptic chemicals. According to Sternberg moist heat at 140 degrees kills the germs in ten minutes. The patient should be cautioned to observe strict cleanliness with reference to his hands and to guard carefully his eyes, not raising to them either soiled hands or towels since gonorrhoeal infection of the eyes nearly always results in the loss of one or both.



Tuberculosis.

TUBERCULOSIS is an infectious disease the course of which is sometimes acute, sometimes chronic. The affection is characterized by little nodular bodies called tubercles. These bodies undergo either caseation, or sclerosis or become calcified.

The specific cause of tuberculosis is a bacillus known as the bacillus tuberculosis. This organism is identified by peculiar methods of staining. The micro-organism is found in all tubercular tissue and especially in developing tubercles.

Most cases of tuberculosis are doubtless due to a direct infection from sputum. Spitting on streets and floors, hanging up cloths to dry after

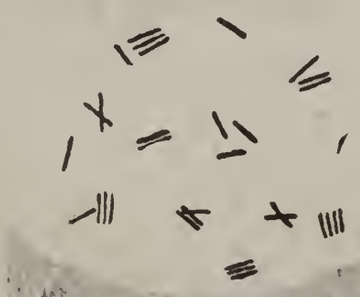


Figure XXXVII.

Bacillus Tuberculosis.

they have been used to catch sputum, closely confined atmosphere in infected rooms, poor light and poor qualities of food are all potent factors in the spread of tuberculosis. Domestic animals are affected but a question has been raised recently as to the power to transmit tuberculosis from domestic animals to man and is at present unsettled. Extremely rare cases appear to be congenital. The influence of heredity is an open question, a matter the truth of which is hard to determine. Most cases attributed to heredity are

probably the result of lowered resistance favoring ready response to infection. The expired air of a tuberculous patient is usually not infectious but the sputum is highly so and in a dried state is easily carried about as dust particles. Infection with ingesta is possible but as a rule infection of the alimentary tract is subsequent to an infection of the air passages. Tuberculosis or the tendency to tuberculosis seems to be more frequently transmitted through the mother than the father. Races as such are not immune but certain peoples seem to be more commonly affected than others. For instance, the Irish, Negroes and Indians are very susceptible whilst among the Jews tuberculosis is not so common. Recently this alleged immunity of the Jews has been called in question however and it is possible the condi-

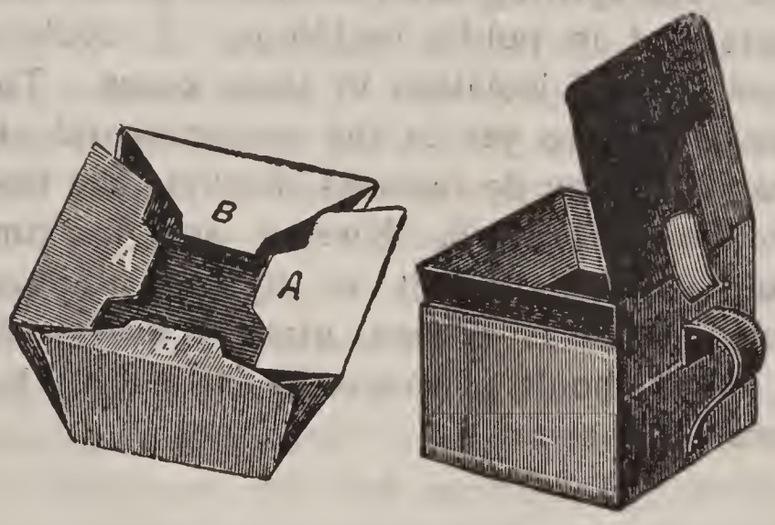


Figure XXXVIII.

Sputum cup and paper filler.

tions may be the result of differences other than racial. All ages are affected but most cases occur from eighteen to thirty-five years of age while from five to ten years of age there seems to be a period of relative immunity.

Incubation, owing to the very insidious nature

of the infection is hard to determine and differs greatly no doubt in different cases.

The diagnosis is usually plainly marked in the clinical picture though at times may be difficult to make out. The microscope affords a valuable aid to the diagnosis. Diagnosis is sometimes most easily effected by means of exclusion. The rapid loss of weight and a continued slight elevation of temperature are frequently considered diagnostic although it is hardly safe to rely on these two symptoms alone. Local symptoms depend on the parts involved.

The sanitary regulations to be observed should include disinfection of all discharges by fire, bed linen and other wash goods by moist heat (either steam under pressure or boiling for thirty to sixty minutes), and plenty of fresh air and sun light. The spitting habit should be prohibited on streets and in public buildings. I doubt the advisability of isolation in these cases. Tubercular farms are yet in the experimental stage. What they may do towards checking the disease is yet to be learned. Kissing and matrimony should not be thought of by the tubercular. Utensils such as spoons, glasses, knives, forks and dishes should of course be thoroughly boiled before using again.

Malaria.

MALARIA is an infectious disease manifesting itself in a variety of types which are classed as separate diseases by some writers. All, however, are caused by the micro-organism known as the plasmodium of malaria. The plasmodium of malaria differs in several respects from the bacteria the organism belonging to the class protozoa, being one celled structures having the characteristics of animals. The differentiation is not essential in this connection. The different affections classified under the general head malaria are characterized by one common symptom, periodicity and periodicity in a section in which malaria is found always suggests this affection. The various names of the different types of malaria arise frequently from some peculiarity of symptom or course found in the one form of malarial manifestation. The plasmodium of malaria is found in the blood. Of this organism are found several different varieties which occasion differing cycles of disease process. For a differentiation and classification of these varieties the reader is referred to any standard work on the pathological parasites.

As conditions favorable to the development of malarial affections may be mentioned a warm, temperate or tropical climate and a low marshy ground. A plowing or stirring up of the ground seems for a time to aggravate matters, but continued cultivation and the planting of trees are advantageous. A drainage of swamps also seems to afford considerable relief. Lands once under cultivation and permitted to relapse to the wild state are particularly likely to favor the development of malarial agencies. The summer and fall

are the seasons at which malarial processes are most likely to appear.

Impure drinking water has been severely arraigned by some and acquitted by others. It seems reasonable to suppose that bad water or at least stagnant water affords an excellent breeding place for the contagion. It cannot be denied at least that stagnant water affords ideal breeding places for the mosquito which has been tried and found guilty of transmitting malaria, inoculating its victims as it gets its food.

Age is not an important factor of susceptibility or immunity.

Widely differing views have been expressed on the question of incubation. It is still an open question on which nothing definite can be said as to the duration.

Diagnosis depends on the microscope and the clinical picture of a given type. Differentiation must be made from typhoid fever aside from which possibly there need be little or no confusion in diagnosis. In masked forms of malaria, however, grave errors of diagnosis may be committed. Susceptibility to a large degree depends on acclimation of the individual and the resistive powers he may be able to command.

To avoid malarial infection when in malarial districts one should sleep on the second or third floor and should take a daily dose of quinine. Since the mosquito has been proven to be a factor in malarial infection screens should guard sleeping apartments. In addition to the above sanitary precautions may be mentioned the liberal use of coal oil as a destructive agent to the mosquito in its early stages of development. The oil is to be used freely on the stagnant water of suspected breeding places.

Dengue or Breakbone Fever.

DENGUE OR BREAKBONE FEVER, an acute infectious disease is characterized by two paroxysms of fever and severe pain. The affection is doubtless caused by a specific germ but this fact has not been proven. Dengue is found in warm and hot climates and seems to be favored by a warm, moist atmosphere. The susceptibility does not seem to depend in any special degree on age, race, sex or social position.

Dengue prevails in epidemic form, but its communicability has been questioned. Immunity and recurrent attacks are also unsettled questions, good authority being arrayed on both sides. Incubation last from two to five days.

Chief reliance must be made on the clinical picture in making a diagnosis holding in mind the characteristic symptoms. These are rigors, two paroxysms of fever, a rash, occasionally hemorrhages from mucous membranes, great pain, pronounced depression and a slow convalescence. If there be any confusion it is likely to be made with yellow fever but this need only occur in isolated cases if at all. Malaria and typhoid fever might also be considerations in making a diagnosis but a careful analysis of the symptoms and recourse to the microscope should clear away all doubt with reference to these affections. Other than general hygenic principles there are no sanitary precautions to be recommended. Quinine, however, is said to be prophylactic in some degree.

Relapsing Fever.

RELAPSING FEVER is an acute infectious disease characterized as suggested by the name, by intermission and relapses. The specific cause of relapsing fever like that of most other communicable diseases is a micro-organism, in this instance the spirochaeta Obermeieri. This organism is found in the blood but only during the fever. The habitat and life history of the organism is not yet known. Neither do we know just how it is given off from the system, but that it is so given off we know from the fact the disease is communicated by personal contact. From one to fourteen days with an average of seven days are the time limits usually placed on the period of incubation. Diagnosis depends on the characteristic symptoms to be verified by the microscope.

Susceptibility to relapsing fever seems to be greatest between the ages of fifteen and twenty-five though no age is exempt. Sex and season do not seem to be of any great importance in this relation.

The sanitary precautions resolve themselves into isolation, plenty of good, nutritious food and proper hygienic observations including good ventilation.

Dysentery.

DYSENTERY is a term including a number of differing types of disease process; all showing in some degree inflammation of the colon, all characterized by frequent stools, pain, straining and prostration, and all probably due to parasitic origin, the amoebic form certainly so. This latter type, amoebic dysentery, is due to the amoeba coli. Irritating ingesta, climate, sudden change of temperature, constipation and bad water should all be included in a list of contributory causes. No age seems to be exempt. Incubation though probably of short duration is an unsettled question. The clinical

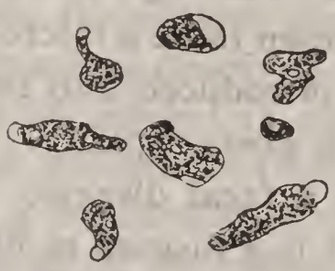


Figure XXXIX.

Amoeba Coli.

picture aided by the microscope in the amoebic form furnishes the means of diagnosis.

The sanitary precautions to be observed are the same as those given for guidance in typhoid fever cases. The stools and all soiled bedding or clothing should be thoroughly disinfected, special care being taken to avoid contaminating the water supply which should it is needless to say be of first quality. General hygienic measures should prevail.

Attacks of dysentery render no immunity. Two complications are to be expected in a certain percentage of the cases, namely, abscesses of the liver and of lung tissue.

Yellow Fever.

YELLOW FEVER is an acute infectious disease characterized by fever, suppression of urine and passive hemorrhage from the mucous surfaces. There is likewise great depression. Strictly speaking the disease is infectious rather than contagious disease occupying in this respect a like position with typhoid. Immediate contact is neither sufficient nor always essential to occasion yellow fever. The essential factor is the introduction of the contagion or infectious element into the system. This agent is probably though not certainly known to be a micro-organism. The contagion once introduced into the system seems to multiply with great rapidity. Dr. Parks says yellow fever is a fecal disease. All authorities seem to agree it is a disease of filth.

The mosquito is undoubtedly an agent of dissemination of great power and activity so great that some observers are inclined to make it the sole agent of dissemination, even to excluding fomites as a factor. The latter position, to my mind, seems rather extreme, though I have had no opportunity for personal observation. The affection is essentially a disease of hot climates and is usually confined to the larger cities along the sea coast. During epidemics, however, it may invade the inland to some considerable extent along lines of travel. This fact would seem to argue some little against the mosquito as a sole agent of dissemination.

Acclimated persons seem to be rather less susceptible than travelers and Negroes seem less

susceptible than either acclimated whites or travelers. This feature of the Negro is manifested in a mildness of attack however rather than absolute immunity.

The period of incubation is estimated at from one to five days, sometimes even longer.

The diagnosis of yellow fever is largely dependent on the clinical picture and is sometimes very difficult in isolated cases. During epidemics of course the diagnosis is greatly simplified.

The disease is transmissible throughout its entire course and following until proper disinfection has been executed. Immunity follows an attack.

In yellow fever the patient should be isolated and a strict quarantine observed. Thorough disinfection should be applied to all clothing, bedding, rooms and excreta and efforts should be directed toward a destruction of the mosquito by means of petroleum in the swamps and breeding places of the insect as before described (see Malaria).

Cholera.

CHOLERA is a very acute infectious disease characterized by great depression, vomiting, pain, diarrhoeal discharges, emaciation, etc.

A micro-organism known as the spirillum of cholera is the specific causative agent of this affection. As contributory factors in the causation of cholera may be again mentioned the usual category of filth, warmth, moisture, debauchery or any thing that tends to a lower vitality. Contrary to the opinion of the general public cholera is not transmitted through the air directly, but is introduced into the system through the agency of food or water.

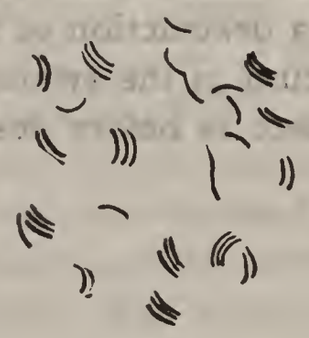


Figure XL.
Spirillum of cholera.

The diagnosis depends on the clinical picture and on the microscopic findings. It more nearly resembles cholera morbus or cholerine than any other affection but in cholera the depression is very much more profound. In cases where the diagnosis is at all in doubt however the microscope is conclusive evidence pro or con. The course of cholera is a rapid one in the fatal cases but in other cases convalescence is prolonged throughout weeks.

From what has been said regarding the etiology of cholera it will be readily seen that cleanliness is a prime factor in the prevention of the disease. Cholera centers, such as are found in certain parts of the world as a result of massing great assemblages of people of filthy habits, should be stamped out either by the prevention of such assembling or by the enforcement of most rigid sanitary regulations overcoming the filth. The germs of cholera do not withstand the action of sunlight and drying to any great extent, hence in natural forces if but given opportunity we have powerful allies. As direct sanitary measures should be employed (using the most exacting methods hereinbefore described) disinfection of the hands, person and clothing of physician and attendants, all dejecta, clothing, bedding, rooms and in short all infected material observing strict quarantine precautions until such measures have been observed. As a disinfectant a carbolic acid solution of not less than one per cent strength is very efficient.

The Plague.

THE PLAGUE, an acute infectious disease which has of late occasioned much interest in this country owing to its recent invasion of American soil is characterized by fever, inflammation of the lymphatic glands, particularly those of the groin, and occasionally ecchymoses.

Bubonic plague properly belongs in the eastern hemisphere where it prevails in widespread epidemics and is extremely fatal. The disease is due to a specific micro-organism of the class bacillus. Poor food, filth and mental or physical depression again act as predisposing or contributary causes. Rats are said to be important agents in the dissemination of the disease.

It is strange but none the less true that persons of fifty years and over are but seldom attacked.

The contagium of the plague usually enters the system through the respiratory organs, the alimentary tract or skin abrasions. It is very potent. After infection, follows a period of incubation lasting from two to eight days. The usual period of incubation however is not longer than five days.

The diagnosis depends on the clinical picture as outlined in the characteristic symptoms mentioned above, to be verified by the microscope. The characteristic symptoms are as a rule so plain as to occasion but little or no doubt.

The sanitary requirements are similar to those given for cholera. All conditions which might be classed as contributory should be removed. Quarantine restrictions should be rigidly enforced throughout the entire period of possible trans-

mission. There should be a thorough disinfection of all exposed rooms, articles of furniture, clothing, dejecta, persons, corpses, etc. The final disposition of a body dead from the plague is a most important consideration since they are capable of transmitting the disease for a time. Cremation is probably the best method of disposal of these bodies, though a thorough embalmment and disinfection as outlined in Chapter VIII. may be employed where for any reason cremation is impracticable.

The affection seems to be communicable throughout the entire course of the disease and as indicated above until proper distinfection methods have been employed.

Blood Poison.

BLOOD POISON is a very indefinite term which includes a number of disease processes all (save perhaps one form) infectious, all acute, all the direct or indirect result of micro-organisms and all of more or less gravity. Three forms of the disease process however constitute the cases usually classed as "blood poison." These three forms are occasioned in the following manners: There may be an introduction into the system of a toxine (poison) the result of bacterial activity which probably acts as a disease producing agent in a purely chemical manner. This form is known as sapraemia. There may be introduced into the system micro-organisms which multiply and generate toxines which are not local irritants and which do not induce secondary abscesses but which occasion disease processes through their toxic effect on the nervous system. This form is known as septicaemia. Again there may be introduced into the system micro-organisms which multiply, which are local irritants or which generate toxines which act as such and which occasion secondary abscesses at widely distributed points. This form is known as pyaemia. These three forms of blood poison may be united in various combinations. Indeed a case of pure sapraemia, pure septicaemia or pure pyaemia is the exception rather than the rule.

We have a group of micro-organisms known as the saprophytic bacteria which act as agents in reducing dead organic matter to more simple forms and to this class belong the organisms which occasion putrefaction of dead animal tis-

sue. In this process of putrefaction are formed certain substances, chemical in character, some of which are highly poisonous. To these bodies have been given the name ptomaines. The most recent observations however make it a question of some considerable doubt as to the most toxic of the bacterial products being properly classed with the ptomaines but fail to give us anything more definite as to their nature or proper classification. But regardless as to whether they be ptomaines or not we know that highly toxic substances of a number of varieties are generated in the process of putrefaction by bacteria and that of some of these toxic substances a very small quantity if introduced into the blood current is sufficient to occasion alarming results. Too these same substances are capable of occasioning marked toxic symptoms when absorbed from the gastro-intestinal tract.

Briefly stated the symptoms of sapraemia are a chill, (may not be present) fever usually following absorption of the toxines within twenty-four hours, a tongue coated, at first moist and later dry, lessened secretions, headache, prostration, diarrhoea, sometimes vomiting and a muttering delirium. The most pronounced symptom of sapraemia however is prostration.

In septicaemia or septic infection we have a distinctly infectious disease, there being present in the blood micro-organisms which multiply and which generate toxines which are not irritants and which do not occasion secondary abscesses. In sapraemia the toxines are absorbed from a circumscribed source. In septicaemia the toxines are generated within the blood itself after an infection at some given point. In septicaemia the amount of virus or contagium introduced is not

essentially great. Indeed the amount necessary to light up the disease process may be exceedingly small, even microscopic. This is the process which occurs in the so-called "blood-poison" following dissection wounds. There are a variety of different micro-organisms capable of inducing septicaemia differing in different animals and even in the same individual. Their morphology has not as yet been perfectly worked out and is not essential in this connection.

The primary leasion in septicaemia is usually a suppurating wound or an abscess though sometimes a small fresh wound or skin abrasion through which infection occurs. The period of incubation in septicaemia is usually short, say from two to four days. Then follows a chill, fever reaching 102 to 104 F. (sometimes much less) sweating, an erythematus eruption, and prostration. The symptoms are very similar to those of sapraemia with these differences. There is more probability of sweating in septicaemia than in sapraemia and in septicaemia there is a period of incubation, the disease is slower in aggression and more persistent. In cases of septicaemia which follow slight and recent injuries, in addition to the above general symptoms are found locally great swellings, blebs and red lines running from the point of infection in the course of the veins and lymphatics. At the point of infection a vesicle is sometimes formed.

The essential feature of pyaemia is an infection in which micro-organisms are found in the blood which either act as irritants or which generate toxines which act as such and thereby occasion inflammation of the inner coat of blood vessels and secondary abscesses. The infection proceeds from a suppurating surface and therefore pyae-

mia is not to be expected as a complication following an injury until after a lapse of from five to ten days. In the process of suppuration the pus germs invade the lumen of a vessel, cause an inflammation of the inner wall of the vessel and at this point a clot is formed. Portions of this clot or thrombus become detached and form emboli, infected as a matter of course, which are carried in the blood current to some point, it may be very distant from the site of formation, at which they are lodged in new vessels forming new foci for infection. The areas of tissue which these latter vessels supply with blood are, of course, deprived of nutrition and furnish excellent fields for microbic development and abscess formation. These secondary abscesses may be widely distributed throughout the body the lungs however being very frequently among the first of the tissues to be so involved. It is easy to see how new emboli may become detached and a repetition of the process continued indefinitely. In this process it is not infrequent that entire masses of pyogenic organisms become detached and form emboli in the blood current.

The symptomatology of pyaemia is not specially different from that of septicaemia other than as dependent on the secondary abscesses and these differences will suggest themselves.

The various types of "blood poison" present marked differences in postmortem appearances. An effusion of dirty colored fluids into the serous cavities is usually found in septicaemia. The lungs are congested and the liver presents a fatty appearance. The kidneys are also usually congested and present on section what is known as a dirty appearance. Most of the mucous membranes present a greater or less degree of

catarrhal inflammation. Sapraemia when prolonged for any considerable time shows similar changes to those of septicaemia though usually these changes are not of so marked a type. In both forms the mucous lining of the gastro-intestinal tract seems to be particularly affected. The postmortem appearances of pyaemia are much more characteristic. The inner coats of the veins, arteries and heart are inflamed, roughened and softened. Sometimes the inner lining of the heart presents vegetations the most probable situation of these being on the valves. Coagula are sometimes found in the heart and vessels and sometimes the vessel walls are found to be thickened and of a greenish color. Where coagula occlude the lumen of a vessel a wedge shaped area of tissue depending on this vessel for nutrition is found to present a grayish color. This area later breaks down into a purulent mass. Such areas are known as infarcts and are most frequently found in lung tissue though they are by no means confined to these organs. Joints may have become involved in inflammatory processes and show corresponding changes. Hemorrhagic spots are found. In all forms of "blood poison" the postmortem appearance of the blood is that of a dark fluid or semi-fluid, sometimes presenting even the appearance and consistency of tar. It is not often coagulated in the usual sense of the term. Rigor mortis is apt to appear early in these cases and passes off in a short time. Putrefactive changes occur early and progress with marked rapidity. The above postmortem changes are outlined only that the different forms of blood poison may be clearly understood.

There is but one chief factor in the consideration of an individual's susceptibility to "blood poison," namely, physical condition. Age, race and sex apparently do not enter as factors. Given all the conditions save a physical debility or a disturbed gastro-intestinal function and frequently great exposure is followed by no untoward manifestations whilst often a slight exposure in the same individual, with a debility or disturbed stomach or intestine, will result in most alarming or even fatal symptoms.

Pyaemia and septicaemia are regarded as infectious whilst sapraemia is usually not so regarded. The relative gravity of these three forms is expressed in the order of their consideration namely, sapraemia, septicaemia and pyaemia. Sapraemia is not usually fatal providing the source of intoxication be removed early. Septicaemia is of grave import and pyaemia is usually fatal.

The sanitary precautions other than absolute asepsis in all operations and antisepsis in suppurating conditions include general sanitary and hygienic observances; room, clothing and bedding disinfection as before outlined and the destruction of all soiled dressings from wounds, etc. For the body the usual embalmment is sufficient. For further consideration of "blood poison" the reader is referred to the chapter on Wounds of the Knife, Needle, etc.

Puerperal Fever.

PUERPERAL FEVER is an acute infectious disease following labor and characterized by arrested lochia, pain, tenderness, elevation of temperature, rigors and such other symptoms as are attendant on an inflammation of the uterus, its appendages or the peritoneum. As stated above puerperal fever is an infection in many instances being a good example of sapraemia, septicaemia, or pyaemia. The ordinary pyogenic bacteria are the specific organisms concerned, the source of infection being retained secundines, soiled clothing or improperly asepticised hands or instruments of the accoucheur or nurse.

There is usually a period of incubation in puerperal fever lasting about five days. The prophylaxis is embodied in one word, cleanliness—absolute surgical cleanliness. When puerperal fever is met with the patient should be isolated from others in the puerperal or pregnant state and such rules of disinfection employed as were given for erysipelas.

Influenza or LaGrippe.

INFLUENZA OR LA GRIPPE is an acute infectious disease characterized by a catarrhal inflammation of mucous membranes, (particularly those of the respiratory tract) prostration, pain and a tendency to complications such as pneumonia, bronchitis, etc.

A rod shaped bacillus is the specific cause of influenza. Communication may be either direct or indirect the contagium most probably entering the system through the respiratory organs.

Age, sex and race are probably not factors in susceptibility save as they influence powers of resistance, but in prognosis age is an important consideration the affection showing a marked fatality in the aged.

The period of incubation is short and in some cases is doubtless less than twenty-four hours.

The sanitary precautions to be taken are few and briefly stated. Avoid public meetings during the prevalence of influenza. Disinfect the sputum of known or suspected cases. Isolate patients suffering from the affection and treat a body dead of influenza as capable of transmitting the disease.

Pneumonia or Lung Fever.

PNEUMONIA OR LUNG FEVER is an acute infectious disease characterized by a chill, fever, prostration, inflammation of lung tissue involving all or a part of one lung or both lungs, and by such other disturbances of the constitution as might be expected from such inflammation.

The specific cause of pneumonia is the diplococcus pneumonia, the predisposing causes being exposure, lowered vitality, previous attacks and alcoholism.

Figure XLI.

Diplococci of pneumonia imbedded in exudate of fibrin.

All ages are susceptible to pneumonia the fatality however being greatest at the two extremes of life.

The pneumococcus as the organism is sometimes called withstands drying to a marked degree and may be easily transmitted through the atmosphere. Indeed in most cases it is probably so transmitted. In ordinary light and in the dried state the organism will remain virulent for weeks.

Incubation is a matter of but short duration the exact period not having been determined.

Isolation is of prime importance as one of the sanitary precautions which should include free ventilation, and disinfection of sputum either by boiling or burning the cloths used in this manner or where available using the wood pulp boxes made for this purpose (see figure 38) and burning these. Following a case of pneumonia the rooms should be cleansed by the ordinary house-cleaning methods.

Leprosy.

LEPROSY is a chronic infectious disease due to the bacillus leprae and characterized by nodules and areas of anaesthesia due to nerve changes, the above mentioned nodules occurring in the skin and mucous membrane.

There is but little leprosy in America save in Mexico and the Gulf States. All classes of people and all ages are susceptible to leprosy the transmission usually occurring by infection. In this respect leprosy should be placed in the same class as syphilis. According to Morrow most cases are propagated through sexual congress. Heredity is said to be a factor in the transmission of leprosy but to what extent has not been fully determined.

In dealing with leprosy all dressings should be burned, the patient isolated and marriage prohibited.

Lockjaw.

TETANUS OR LOCKJAW is an acute, infectious disease the most characteristic symptom of which is the presence of tonic muscular spasms, the first muscles to become affected being those of the neck and jaw.

The bacillus of tetanus is the specific cause of tetanus. This organism being anaerobic in its nature the infection usually occurs in punctured or penetrating wounds.

All ages are susceptible to tetanus but most cases are found in children and old age. Males

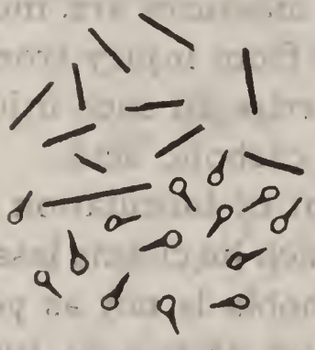


Figure XLII.
Bacillus of tetanus, lower segment showing spore forms.

are more frequently attacked than females doubtless from the greater exposure of the former.

The period of incubation is variously estimated at from one day to three weeks.

The sanitary precautions to be given are avoid penetrating wounds and all injuries where likely to be contaminated with garden soil or infections around stables since these places seem to be more likely to be infected with the tetanic bacilli, and when such injuries do occur see that they are disinfected at once, opened up to free access of air and kept so. Antitetanic serum is also used.

Hydrophobia.

HYDROPHOBIA OR RABIES is an acute infectious disease transmitted from animals to man. The affection is characterized by spasms, a dread of water owing to difficulty of swallowing and increased convulsive action on attempting to do so, fever, mania, unconsciousness and death.

The specific cause of hydrophobia is unknown but the affection follows bites of animals affected in from six to eight weeks. Wider varience of incubation has been estimated but has scarcely been proven.

The sanitary measures are, muzzle all dogs and guard carefully from injury from cases of rabies. Wash and cauterize all such injuries with caustic potash or pure carbolic acid.

The treatment of inoculation as introduced by Pasteur and which he claims lessens the mortality rate of hydrophobia is not as yet in general use.

There is a sort of pseudo hydrophobia which sometimes develops in extremely nervous individuals. Though only a manifestation of hysteria this may occasion some confusion in the diagnosis of true hydrophobia. The following few points should serve to clear away all doubts in this relation. In pseudo hydrophobia there is no elevation of temperature, the disease is not progressive and the patients recover though the attack may last longer than true hydrophobia the entire course of which does not usually last longer than four days.

Anthax or Malignant Pustule.

ANTHAX OR MALIGNANT PUSTULE is an acute infectious disease very common among animals and occasionally affecting man. The characteristic manifestations are rapidly spreading vesicles, oedema and elevation of temperature followed by subnormal temperature. Occasionally the vesicles are absent only the oedema being present, this form of the disease being styled by Osler as malignant oedema and very fatal. Internal forms are met with involving the intestinal tract and the lungs.

The bacillus anthracis is the organism respon-

Figure XLIII.

Bacillus Anthracis.

sible for anthrax. The affection is disseminated through handling infected wool, horns, and skins, through eating infected meat and through the agency of flies.

All carcasses dead from anthrax should be burned or buried deeply with lime, human bodies being treated as those dead from the plague. Dressings should be disinfected by means of fire or boiling for not less than thirty minutes. Pasteur has used protective inoculation with some success in animals. Incubation is so short it should probably be measured in hours.

Actinomycosis or Big Jaw

ACTINOMYCOSIS OR BIG JAW is an acute infectious disease caused by the ray fungus. It is characterized by tumors which break down into pus. These tumors may be situated in the alimentary canal, the brain, the skin or particularly around the mouth from which location

Figure XLIV.

Ray-fungus.

comes the name big jaw. The infection occurs probably from substances taken into the mouth. The case should be handled as one of septicaemia or pyaemia.

Glanders.

GLANDERS is an infectious disease characterized by papules, ulcers and an inflammation of the lymphatics. The disease presents both acute and chronic forms and affects both the horse and man.

The disease is caused by a micro-organism, the bacillus mallei.

Figure XLV.

Bacillus Mallei.

Patients suffering with glanders should be isolated and all dressings burned. If a horse the animal should be killed and either burned or buried with lime. The stable should be cleaned thoroughly, burning such parts as can be removed and burned without too great loss and washing the remainder with a strong solution of chloride of lime. Plenty of whitewash should complete the disinfection.

Trichiniasis.

TRICHINIASIS is an acute disease the characteristic symptoms of which are pain, fever, prostration, gastro-intestinal irritation, inflammation of muscular tissue due to the presence of animal parasites, difficulty of motion, oedema and sweating.

The specific cause of this affection is the trichina spiralis, an animal parasite found in the flesh of swine. The swine are presumed to become infected from feeding on offal from slaughter houses.

The organism is usually taken into the system in an embryonic state through the alimentary tract. From infection until maturity usually requires about three days. Within ten days fully developed embryos are found in hundreds. These migrate via lymph channels to the muscles where they become encapsulated and development proceeds no farther. In this encapsulated state the trichinae may retain vitality for many years.

The diagnosis may be verified by employing a low power lense to search for the worms in the stools, muscles or the remainder of suspected meat. Aside from this process diagnosis must depend on the clinical picture.

In most cases symptoms disappear in from three to eight weeks. Most fatal cases do not last longer than five or six weeks.

In children the affection is not so likely to prove fatal as in adults. The mortality rate varies greatly ranging from 2 to 25 per cent.

But one sanitary precaution suffices, namely complete cooking. A temperature of 140 F. is sufficient to destroy the parasites. Swine should not be fed from offal from slaughter pens.

Scabies or Itch

SCABIES OR ITCH is an affection of the skin either acute or chronic and caused by an animal parasite known as the itch mite or acarus scabiei. The parasites are male and female and the female occasions most of the symptoms and lesions. The symptoms characteristic of itch are itching, and abrasions of the skin due to the scratching. There is a small inflammatory vesicle or papule at the point of penetration of the parasite into the cuticle.

The hands, particularly between the fingers, the forearm, abdomen and thighs are the most usual sites of the affection.

The duration is indefinite.

The prophylaxis consists in avoiding contact with persons affected and the sanitary precautions other than this consist in absolute cleanliness, change of clothing following cure and a complete disinfection of the same for which purpose sulphur answers admirably.

Pediculosis.

PEDICULOSIS. By this term is meant the presence of pediculi or lice on the human body. Three varieties are found on the surface of man's body. The pediculus capitis inhabits the scalp, the pediculus pubis, the pubes and the pediculus vestimenti the clothing. These parasites live on the blood of man and in securing this blood they occasion itching and irritation. They may be seen with the naked eye. They are seldom found away from the quarters above specified.

One precaution suffices as in scabies — avoid contact with persons infected and observe absolute cleanliness. Boiling the clothing and a bath will remove all danger of transmitting the pediculus vestimenti. Combs and hair brushes are factors in distributing the pediculus capitis, whilst the pediculus pubis is transmitted usually in sexual congress or in sleeping in beds formerly occupied by persons inhabited.

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