





mil. med.

United States
Hospital
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OBSERVATIONS
ON THE
DISEASES OF THE ARMY.

BY SIR JOHN PRINGLE, BART.
Late Physician extraordinary to the King, and Physician in ordinary to the
Queen of Great Britain.

WITH NOTES,

BY BENJAMIN RUSH, M. D.
Professor of the Institutes and Practice of Medicine in the University of
Pennsylvania.



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DISTRICT OF PENNSYLVANIA, to wit:

***** BE IT REMEMBERED, That on the seventeenth
* L. S. * day of October, in the thirty-fifth year of the In-
* * * * * dependence of the United States of America, A. D.
* * * * * 1810, Edward Earle, of the said district, hath deposited in this
office the title of a book, the right whereof he claims as proprietor,
in the words following to wit:

“Observations on the Diseases of the Army. By Sir John Pringle, Baronet. Late Physician extraordinary to the King, and Physician in ordinary to the Queen of Great Britain. With notes, by Benjamin Rush, M. D. Professor of the Institutes and Practice of Medicine in the University of Pennsylvania.

In conformity to the act of the Congress of the United States, intituled, “An act for the encouragement of learning, by securing the copies of maps, charts and books, to the authors and proprietors of such copies during the times therein mentioned.” And also to the act, entitled, “An act supplementary to an act, entitled, ‘An act for the encouragement of learning, by securing the copies of maps, charts, and books, to the authors and proprietors of such copies during the times therein mentioned,’ and extending the benefits thereof to the arts of designing, engraving, and etching historical and other prints.”

D. CALDWELL,
Clerk of the district of Pennsylvania.



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DEDICATION.

TO THE

STUDENTS OF MEDICINE

IN

THE UNIVERSITY OF PENNSYLVANIA.

BEHOLD! gentlemen, another attempt by your preceptor to transplant a vigorous and fruitful European plant into the soil of our country; or, in other words, behold, in the following American edition of sir John Pringle's Observations upon the Diseases of the British Army, an attempt to increase and diffuse medical knowledge in the United States from a source to which physicians and learned societies have done homage in every part of the world. The opinions of the illustrious author, with a few exceptions, which are pointed out in the notes by the editor, accord with modern theories of medicine, and his practice is the result of extensive and accurate observations in a climate nearly similar to that in which we live. Permit me to recommend this work to your frequent perusal, and to assure you that the more you know of acute diseases, the more you will perceive the truth of the Observations, and the value of the precepts contained in it.

I have not added any notes to the appendix. The only remark I shall make upon the experiments of the author, as far as they relate to antiseptics, is, that no inference can be made from them to favour a belief of their acting in the same way upon a living body, and that the changes they induce in the fluids when taken into the stomach, are to be ascribed to their primary action upon irritable solids.

The notes of the editor are distinguished from those of the author, by being designated by means of numerical characters.

The account of the life of sir John Pringle, which succeeds this address to you, is extracted from Dr. Hutchison's *Biographia Medica*. You will perceive in it, among many interesting matters, the rewards which await talents honestly and industriously devoted to the service of science and humanity, in extensive business, public honours, royal patronage and affluent circumstances.

With sincere wishes for your happiness,

I am, gentlemen,
very respectfully, your friend,

BENJAMIN RUSH.

October, 1810.

AN ACCOUNT
OF THE
LIFE OF THE AUTHOR.

SIR JOHN PRINGLE, baronet, the late worthy President of the Royal Society, was born at Stichelhouse, in the county of Roxburgh, North Britain, April 10, 1707. His father was sir John Pringle, of Stichel, baronet, and his mother, whose name was Magdalen Elliot, was sister to sir Gilbert Elliot, of Stobs, baronet. Both the families from which he descended were very ancient and honourable ones in the South of Scotland, and were in great esteem for their attachment to the religion and liberties of their own country, and for their piety and virtue in private life. He was the youngest of several sons, three of whom, besides himself, arrived to the years of maturity. His grammatrical education he received at home, under a private tutor; and after having made such a progress as qualified him for academical studies, he was removed to the university of St. Andrew's, where he was put under the immediate care of Mr. Francis Pringle, professor of Greek in the college, and a near relation of his father. Having continued there some years, he went to Edinburgh in October 1727, for the purpose of studying physic, that being the profession he now determined to follow.

At Edinburgh however he stayed only one year, the reason of which was, that he was desirous of going to

Leyden, at that time the most celebrated school of medicine in Europe. Dr. Boerhaave, who had brought that university into reputation, was considerably advanced in years, and Mr. Pringle was unwilling, by delay to expose himself to the danger of losing the benefit of that great man's lectures. For Boerhaave he had a high and just respect; but it was not his disposition and character to become the implicit and systematic follower of any man, however able and distinguished. Whilst he studied at Leyden, he contracted an intimate friendship with Van Swieten, who afterwards became so famous at Vienna, both by his practice and writings. Van Swieten was not only Mr. Pringle's acquaintance and fellow-student at the university, but also his physician when he happened to be seized there with a fit of sickness. Nevertheless, he did not owe his recovery to his friend's advice; for Van Swieten having refused to give him the bark, another prescribed it, and Mr. Pringle was cured.

When he had gone through his proper course of studies at Leyden, he was admitted, July 20, 1730, to the doctor of physic's degree. His inaugural dissertation, "*De Marcove senile,*" was printed. Upon quitting Leyden, Dr. Pringle settled as a physician at Edinburgh, where he gained the esteem of the magistrates of the city, and of the professors of the college, by his abilities and good conduct: and such was his known acquaintance with ethical subjects, that, March 28, 1734, he was appointed by the magistrates and council of the city of Edinburgh to be joint-professor of pneumatics and moral philosophy with Mr. Scott, during the said Mr. Scott's life, and sole professor thereof after his decease; and, in consequence of this appointment, Dr. Pringle was admitted, on the same day, a member of the university. In discharging the

duties of this new employment, his text-book was "Puffendorff de Officio Hominis et Civis;" agreeably to the method he pursued through life of making fact and experiment the basis of science. Dr. Pringle continued in the practice of physic at Edinburgh, and in performing the obligations of his professorship till 1742; when he was appointed physician to the earl of Stair, who then commanded the British army. For this appointment he was chiefly indebted to his friend Dr. Stevenson, an eminent physician at Edinburgh, who had an intimate acquaintance with lord Stair. By the interest of this nobleman, Dr. Pringle was constituted, August 24, 1742, physician to the military hospital in Flanders; and it was provided in the commission, that he should receive a salary of twenty shillings a day, and be entitled to half pay for life. He did not, on this occasion, resign his professorship of moral philosophy; the university permitted him to retain it, and Messrs. Muirhead and Cleghorn were allowed to teach in his absence, as long as he continued to request it.

The eminent attention which Dr. Pringle paid to his duty as an army physician, is a matter that requires no enlargement on in this place, and is apparent from every page of his Treatise on the Diseases of the Army. One thing, however, deserves particularly to be mentioned, as it is highly probable that it was owing to his suggestion. It had hitherto been usual for the security of the sick, when the enemy was near, to remove them a great way from the camp; the consequence of which was, that many were lost before they came under the care of the physicians. The earl of Stair being sensible of this evil, proposed to the duke de Noailles, when the army was encamped at Aschaffenburg in 1743, that the hospitals on both sides should be considered as sanctuaries for the sick, and

mutually protected. The French general, who was distinguished for his humanity, readily agreed to the proposal, and took the first opportunity of showing a proper regard to the agreement. At the battle of Dettingen, Dr. Pringle was in the coach with lord Carteret during the whole time of the engagement, and the situation in which they were placed was dangerous. They had been taken at unawares, and were kept betwixt the fire of the line in front, a French battery on the left, and a wood full of hussars on the right. The coach was occasionally moved to avoid being in the eye of the battery. Soon after this event, Dr. Pringle met with no small affliction in the retirement of his great friend, the earl of Stair, from the army. He offered to resign with his noble patron, but was not permitted. He, therefore, contented himself with testifying his respect and gratitude to his lordship by accompanying him forty miles on his return to England; after which he took leave of him with the utmost regret.

But though Dr. Pringle was thus deprived of the immediate protection of a nobleman, who knew and highly esteemed his worth, his conduct in the duties of his station procured him effectual support. He attended the army in Flanders through the campaign of 1744; and so powerfully recommended himself to the duke of Cumberland, that in the spring following, March 11, he had a commission from his royal highness, appointing him physician general to his majesty's forces in the Low Countries, and parts beyond the seas: and on the next day, he received a second commission from the duke, by which he was constituted physician to the royal hospitals in the same countries. On March 5, he resigned his professorship, in consequence of these promotions. In 1745, he was with the

army in Flanders, but was recalled from that country in the latter end of the year, to attend the forces which were to be sent against the rebels in Scotland. At this time he had the honour of being chosen Fellow of the Royal Society. The election took place October 30, and the society had reason to be pleased with the addition of such a member.

Dr. Pringle, at the beginning of 1746, accompanied in his official capacity, the duke of Cumberland in his expedition against the rebels, and remained with the forces after the battle of Culloden, till their return to England in the middle of August. We do not find that he was in Flanders during any part of that year. In 1747 and 1748, he again attended the army abroad, and in the autumn of 1748, he embarked with the forces for England upon the conclusion of the treaty of Aix-la-Chapelle. From that time he principally resided in London, where, from his known skill and experience, and the reputation he had acquired, he might reasonably expect to succeed as a physician. In April 1749, Dr. Pringle was appointed physician to his royal highness the duke of Cumberland.

In 1750 he published, in a letter to Dr. Mead, "Observations on the Jail or Hospital-Fever." This piece, which passed through two editions, and was occasioned by the jail distemper that broke out at that time in the city of London, was well received by the medical world, though he himself afterwards considered it as having been hastily written. After supplying some things that were omitted, and rectifying a few mistakes that were made in it, he included it in his grand work on the "Diseases of the Army," where it constitutes the seventh chapter of the third part of that treatise.

It was in the same year that Dr. Pringle began to communicate to the royal society his famous "Experiments upon septic and antiseptic substances, with remarks relating to their use in the theory of medicine." These experiments, which comprehended several papers, were read at different meetings of the society; the first in June, and the next two in the November following; three more in the course of the year 1751; and the last in February 1752. Only the first three numbers were printed in the "Philosophical Transactions," as Dr. Pringle had subjoined the whole by way of appendix to his "Observations on the Diseases of the Army." The experiments made upon septic and antiseptic substances, which have accompanied every edition of the treatise just mentioned, procured for our ingenious physician the honour of sir Godfrey Copley's gold medal. Besides this, they gained him a high and just reputation as an experimental philosopher.

In February 1753, he presented to the royal society "An Account of several persons seized with the Jail Fever by working in Newgate: and of the manner by which infection was communicated to one entire family." This was a very curious paper; and it was deemed of such importance by the excellent Dr. Stephen Hales, that he requested the author's permission to have it published, for the common good of the kingdom, in the "Gentleman's Magazine," where it was accordingly printed, previous to its appearance in the "Transactions."

Dr. Pringle's next communication was "A remarkable Case of Fragility, Flexibility, and Dissolution of the Bones." In the 49th volume of the "Transactions" we meet with an account, which he had given of an earthquake felt at Brussels; of another at Glas-

gow and Dunbarton; and of the agitation of the waters, November 1, 1756, in Scotland and at ·Hamburgh. The 50th volume contains observations by him on the case of lord Walpole of Woolterton, and a relation of the virtues of soap in dissolving the stone, as experienced by the rev. Mr. Matthew Simpson. The next volume is enriched with two of the doctor's articles, of considerable length as well as value. In the first he has collected and related the different accounts, that had been given of a very extraordinary fiery meteor, which appeared on Saturday, the 26th of November 1758, between eight and nine o'clock at night, and in a second, he has made a variety of remarks upon the whole, whercin is displayed no small degree of philosophical sagacity. It would be tedious to mention the various papers, which, both before and after he became president of the royal society, were transmitted through his hands. Besides his communications in the "Philosophical Transactions," he wrote in the "Edinburgh Medical Essays," volume fifth, an "Account of the success of the vitrum ceratum antimonii."

April 14, 1752, Dr. Pringle married Charlotte, the second daughter of Dr. Oliver, an eminent physician at Bath, and who had long been at the head of his profession in that city. This connexion did not last long, that lady dying in the space of a few years.

Nearly about the time of his marriage, Dr. Pringle gave to the public the first edition of his "Observations on the Diseases of the Army." It was reprinted in the year following, with some additions. To the third edition, which was greatly improved from the farther experience the author had gained by attending the camps for three seasons in England, an appendix was annexed in answer to some remarks, which pro-

fessor De Haen, of Vienna, and M. Gaber of Turin, had made on the work. The like attention was paid to the improvement of the treatise, in every subsequent edition. The work is divided into three parts: the first of which, being principally historical, may be read with pleasure by every gentleman. The latter parts lie more within the province of physicians, they alone are the best judges of the merits of the performance, and to its merit the most decisive and ample testimonies have been given. It has gone through seven editions at home; and abroad it has been translated into the French, the German, and the Italian languages. Scarcely any medical writer has mentioned it without some tribute of applause. Ludwig, in the second volume of his "Commentarii de Rebus in Scientiâ naturali et Medicina gestis," speaks of it highly; and gives an account of it which comprehends sixteen pages. The celebrated and eminent baron Von Haller, in his "Bibliotheca Anatomica," with a particular reference to the treatise of which we are speaking, styles the author "Vir illustris de omnibus bonis testibus bene "meritus." It is allowed to be a classical book, and has placed the writer of it in rank with the famous Sydenham. Like Sydenham too, he became eminent, not by the quantity, but by the value of his productions; and has afforded a happy instance of the great and deserved fame, which may sometimes arise from a single performance. The reputation, that Dr. Pringle gained by his "Observations on the Diseases of the Army," was not of a kind which is ever likely to diminish. The utility of the work, however, was of still greater importance than its reputation. From the time that he was appointed physician to the army, it seems to have been his grand object to lessen, as far as lay in his power, the calamities of war; and he was

not without considerable success in his noble and benevolent design. The benefits, which may be derived from our author's grand work, are not solely confined to medical men. General Melville, a gentleman who unites with his military abilities the spirit of philosophy and humanity, was enabled, when governor of the neutral islands, to be singularly useful, in consequence of the instructions he had received from Dr. Pringle's book, and from personal conversation with him. By taking care to have his men always lodged in large, open, and airy apartments, and by never permitting his forces to remain long enough in swampy places to be injured by noxious airs, the general was the happy instrument of saving the lives of several hundred soldiers.

In 1753, Dr. Pringle was chosen one of the council of the royal society. Though he had not for some years been called abroad, he still held his place as physician to the army; and, in the war which commenced in 1755, attended the camps in England during three seasons. This enabled him, from farther experience, to correct some of his former observations, and to give additional perfection to the third edition of his work. In 1758, he entirely quitted the service of the army, and being determined to fix now wholly in London, he was admitted a licentiate of the college of physicians, July 5th, in the same year. The reason, why this matter was so long delayed, might probably be his not having hitherto come to a final resolution with regard to his settlement in the metropolis.

After the accession of his present majesty to the throne of Great-Britain, Dr. Pringle was appointed, in 1761, physician to the queen's household; and this honour was succeeded by his being constituted, in 1763, physician extraordinary to her majesty. April

12th, in the same year, he had been chosen a member of the academy of sciences at Haerlem; and in June following, he was elected a fellow of the royal college of physicians, London. In the succeeding November, he was returned on the ballot, a second time, one of the council of the royal society; and in 1764, on the decease of Dr. Wollaston, he was made physician in ordinary to the queen. February 14, 1766, he was elected a foreign member, in the physical line, of the royal society of sciences at Gottingen; and on the 5th of June in that year, his majesty was graciously pleased to testify his sense of Dr. Pringle's abilities and merit, by raising him to the dignity of a baronet of Great Britain. July 18, 1768, sir John Pringle was appointed physician in ordinary to her late royal highness the princess dowager of Wales, to which office a salary was annexed of one hundred pounds a year. In 1770, he was chosen, a third time, into the council of the royal society; as he was likewise, a fourth time, for the year 1772; and Nov. 30, in that year, in consequence of the death of James West, esq. he was elected president of that illustrious and learned body.

His election to this high station, though he had so respectable a character as the late sir James Porter for his opponent, was carried by a very considerable majority. This was undoubtedly the highest honour sir John Pringle ever received; an honour with which his other literary distinctions could not be compared. It was at a very auspicious time, that sir John Pringle was called upon to preside over the royal society. A wonderful ardour for philosophical science, and for the advancement of natural knowledge, had of late years displayed itself through Europe, and had appeared with particular advantage in our own country. He endeavoured to cherish it by all the methods that were in his power; and

he happily struck upon a new way to distinction and usefulness, by the discourses which he delivered on the annual assignment of sir Godfrey Copley's medal. This gentleman had originally bequeathed five guineas, to be given at each anniversary meeting of the royal society, by the determination of the president and council, to the person who had been the author of the best paper of experimental observations for the year past. In process of time, this pecuniary reward, which could never be an important consideration to a man of an enlarged and philosophical mind, however narrow his circumstances might be, was changed into the more liberal form of a gold medal; in which form it is become a truly honourable mark of distinction, and a just and laudable object of ambition. It was, no doubt, always usual with the president on the delivery of the medal, to pay some compliment to the gentleman on whom it was bestowed; but the custom of making a set speech on the occasion, and of entering into the history of that part of philosophy to which the experiments related, was first introduced by Mr. Martin Folkes. The discourses, however, which he and his successors delivered, were very short, and were only inserted in the minute-books of the society. None of them had ever been printed before sir John Pringle was raised to the chair. The first speech that was made by him being much more elaborate and extended than usual, the publication of it was desired, and with this request, it is said, he was more ready to comply, as an absurd account of what he had delivered had appeared in a newspaper. Sir John Pringle was very happy in the subject of his primary discourse. The discoveries in magnetism and electricity had been succeeded by the inquiries into the various species of air. In these inquiries Dr. Priestly, who had already

distinguished himself by his electrical experiments, and his other philosophical pursuits and labours, took the principal lead. A paper of his, entitled, "Observations on different kinds of air," having been read before the society in March 1772, was adjudged to be deserving of the gold medal; and sir John Pringle embraced with pleasure the occasion of celebrating the important communications of his friend, and of relating with accuracy and fidelity what had previously been discovered on the subject. At the close of the speech, he earnestly requested Dr. Priestly to continue his liberal and valuable inquiries; and we need not say how eminently the doctor has fulfilled this request.

It was not intended, we believe, when sir John Pringle's first speech was printed, that the example should be followed; but the second discourse was so well received by the royal society, that the publication of it was unanimously requested. Both the discourse itself, and the subject on which it was delivered, merited such a distinction. The composition of the second speech is evidently superior to that of the former; sir John having probably been animated by the favourable reception of his first effort. His account of the torpedo, and of Mr. Walsh's ingenious and admirable experiments, relative to the electrical properties of that extraordinary fish, is singularly curious. The whole discourse abounds with ancient and modern learning, and exhibits sir John Pringle's knowledge in natural history, as well as in medicine, to great advantage.

The third time that he was called upon to display his abilities at the delivery of sir Godfrey Copley's medal, was on an eminently beautiful and important occasion. This was no less than Dr. Maskelyne's successful attempt, completely to establish sir Isaac Newton's system of the universe, by his "Observations

“made on the mountain Schehallien, for finding its “attraction.” Sir John Pringle laid hold of this opportunity, to give a perspicuous and accurate relation of the several hypotheses of the ancients, with regard to the revolutions of the heavenly bodies, and of the noble discoveries with which Copernicus enriched the astronomical world. He then traces the progress of the grand principle of gravitation down to sir Isaac’s illustrious confirmation of it; to which he adds a concise narrative of Messrs. Bouguer’s and Condamine’s experiment at Chimboraco, and of Dr. Maskelyne’s at Schehallien. If any doubts still remained with respect to the truth of the Newtonian system, they were now totally removed.

Sir John Pringle had reason to be peculiarly satisfied with the subject of his fourth discourse; it being perfectly congenial to his disposition and studies. His own life had been much employed in pointing out the means, which tended not only to cure, but to prevent the diseases of mankind; and it is probable, from his intimate friendship with captain Cook, that he might suggest to that sagacious commander some of the rules, which he followed, in order to preserve the health of the crew of his majesty’s ship the Resolution, during her voyage round the world. Whether this were the case, or whether the method pursued by the captain, to attain so salutary an end, were the result of his own reflections alone, the success of it was astonishing; and this famous voyager seemed well entitled to every honour that could be bestowed. To him the society assigned their gold medal, but he was not present to receive the honour. He was gone out upon the voyage from which he never returned. In this last voyage he continued equally successful in maintaining the health of his men.

In his next annual dissertation, the president had an opportunity of displaying his knowledge in a way, in which it had not hitherto appeared. The discourse took its rise from the prize-medal's being adjudged to Mr. Mudge, then an eminent surgeon at Plymouth, upon account of his valuable paper containing "Directions for making the best Compositions for the Metals of Reflecting Telescopes; together with a Description of the Process for grinding, polishing, and giving the great Speculum the true parabolic form." Sir John accurately related a variety of particulars concerning the invention of reflecting telescopes, the subsequent improvements of these instruments, and the state in which Mr. Mudge found them, when he first set about working them to greater perfection, till he had truly realized the expectation of sir Isaac Newton; who, above a hundred years ago, presaged, that the public would one day possess a parabolic speculum not accomplished by mathematical rules, but by mechanical devices.

Sir John Pringle's sixth discourse, to which he was led by the assignment of the gold medal to Mr. (now Dr.) Hutton, on account of his curious paper, entitled, "The force of fired Gun-powder, and the initial velocity of Cannon-balls determined by experiments," was on the theory of gunnery. Though sir John had so long attended the army, this was probably a subject to which he had heretofore paid very little attention. We cannot, however, help admiring with what perspicuity and judgment he has stated the progress that was made, from time to time, in the knowledge of projectiles, and the scientific perfection to which his friend Dr. Hutton had advanced this knowledge. As sir John Pringle was not one of those who delighted in war, and in the shedding of human

blood, he was happy in being able to show, that even the study of artillery might be useful to mankind; and therefore this is a topic, which he has not forgotten to mention. Here ended our author's discourses upon the delivery of sir Godfrey Copley's medal. If he had continued to preside in the chair of the royal society, he would, no doubt, have found other occasions of displaying his acquaintance with the history of philosophy. But the opportunities which he had of signaling himself in this respect were important in themselves, happily varied, and sufficient to gain him a solid and permanent reputation.

Several marks of literary distinction had been conferred upon sir John Pringle, before he was raised to the president's chair. But after that event they were bestowed upon him in great abundance: and to prevent our resuming the subject, we shall here collect them together. Previously, however, to these honours, except his having been chosen a fellow of the society of antiquaries of London, he received the last promotion, that was given him in his medical capacity, which was his being appointed November 4, 1774, physician extraordinary to his Majesty. In the year 1776, he was enrolled in the list of the members of no less than four learned bodies. These were the royal academy of sciences at Madrid, the society at Amsterdam for the promotion of agriculture; the royal academy of medical correspondence at Paris; and the imperial academy of sciences at St. Petersburg. The dates of sir John Pringle's election into these eminent societies, according to the order in which we have mentioned them, were on the 12th February, in the month of September, and on the 28th and 29th of December. July 5, 1777, sir John Pringle was nominated, by his serene highness the landgrave of Hesse,

an honorary member of the society of antiquaries at Cassel. In 1778, he succeeded the celebrated Linnæus, as one of the foreign members of the royal academy of sciences at Paris. This honour is extended by that illustrious body to eight persons only, on which account it is justly esteemed a very eminent mark of distinction; and we believe there have been few or no instances, wherein it has been conferred on any other than men of great and acknowledged abilities and reputation. October 11th, in the same year, our author was chosen a member of the medical society at Hanau. In the succeeding year, March 29th, he was elected a foreign member of the royal academy of sciences and belles lettres at Naples. The last testimony of respect in this way, which was bestowed upon sir John, was his being admitted, in 1781, into the number of the fellows of the newly instituted society of antiquaries at Edinburgh. The particular design of this society was to investigate the history and antiquities of Scotland; and from the known characters and literature of the gentlemen who compose it, there can be little doubt but that the end they have in view will be successfully accomplished.

Sir John Pringle was in his sixty-sixth year, when he was elected president of the royal society. Considering, therefore, the extreme attention that was paid by him to the various and important duties of his office, and the great pains he took in the preparation of his discourses, it was natural to expect, that the burden of his honourable station should grow heavy upon him in course of time. This burden was increased not only by the weight of years, but by the accident of a fall in the area in the back part of his house, from which he received considerable hurt, and which, in consequence, affected his health and weakened his

spirits. Such being the state of his body and mind, he began to entertain thoughts of resigning the president's chair. It has been also said and believed, that he was much hurt by the disputes introduced into the society concerning the question, whether pointed or blunt electrical conductors be the most efficacious in preserving buildings from the pernicious effects of lightning. Perhaps sir John Pringle's declining years, and the general state of his health, will form sufficient reasons for his resignation. His intention, however, was disagreeable to many of his friends, and to many distinguished members of the royal society. Accordingly, they earnestly solicited him to continue in the chair; but his resolution being fixed, he resigned it at the anniversary meeting in 1778. The present worthy president, sir Joseph Banks, then Joseph Banks, esq. was unanimously elected to succeed him; a gentleman in the prime and vigour of his life, who had eminently distinguished himself by his acquaintance with natural history; who had sailed round the globe, and performed other voyages in pursuit of that branch of science; and who has amply justified the choice that was made of him, by his attention to every part of his duty, and his assiduous concern to promote the interest and honour of the society.

Though sir John Pringle quitted his particular relation to the royal society, and did not attend its meetings so constantly as he had formerly done, he still retained his literary connexions in general. His house continued to be the resort of ingenious and philosophical men, whether from his own country or from abroad; and he was frequent in his visits to his friends. He was held in particular esteem by eminent and learned foreigners, none of whom came to England without waiting upon him, and paying him the greatest res-

pect. He treated them in return with distinguished civility and regard. When a number of gentlemen met at his table, foreigners were usually a part of the company.

Sir John Pringle's infirmities increasing, he hoped that he might receive an advantage from an excursion to Scotland, and spending the summer there, which he did in 1780; and principally at Edinburgh. He had probably then formed some design of fixing his residence in that city. However this may have been, he was so well pleased with a place, to which he had been habituated in his younger days, and with the respect shown him by his friends, that he purchased a house there, whither he intended to return in the following spring. When he came back to London, he set about preparing to put his scheme into execution. Accordingly, having first disposed of the greater part of his library, he sold his house in Pall-Mall, in April 1781, and some few days after he removed to Edinburgh. In this city he was treated by persons of all ranks with every mark of distinction. But Edinburgh was not now to him what it had been in early life. The vivacity of spirits, which in the days of youth spreads such a charm on the objects that surround us, was fled. Many, if not most, of Sir John Pringle's old friends and contemporaries were dead; and though some of them remained, they could not meet together with the same strength of constitution, the same ardour of pursuit, the same animation of hope, which they had formerly possessed. The younger men of eminence paid him the sincerest testimony of esteem and regard; but it was too late in life for him to form new habits of close and intimate friendship. He found also the air of Edinburgh too sharp and cold for his frame, which had long been peculiarly sensible to severities

of weather. These evils were exaggerated by his increasing infirmities, and perhaps by that restlessness of mind, which, in the midst of bodily complaints, is still hoping to derive some benefit from a change of place. He determined, therefore, to return once more to London, where he arrived in the beginning of September.

Before sir John Pringle entirely quitted Edinburgh, he requested his friend, Dr. John Hope, to present ten volumes, folio, of "Medical and physical Observations," in manuscript, to the royal college of physicians in that city. This benefaction was conferred on two conditions: first, that the observations should not be published; and secondly, that they should not be lent out of the library on any pretence whatever. A meeting of the college being summoned upon the occasion, sir John's donation was accepted with much gratitude, and a resolution passed to comply with the terms on which it was bestowed. He was at the same time preparing two other volumes to be given to the university, containing the formulæ referred to in his annotations.

Sir John Pringle, upon his arrival at the metropolis, found his spirits somewhat revived. He was greatly pleased with revisiting his London friends, and he was received by them with equal cordiality and affection. His Sunday evenings' conversations were honoured with the attendance of many respectable men; and on the other nights of the week, he had the pleasure of spending a couple of hours with his friends, at a society that had long been established, and which had met, for some time past, at Mr. Watson's, a grocer in the strand. Sir John's connexion with this society, and his constant attendance upon it, formed to the last, one of his principal entertainments. The morning was chiefly

employed by him in receiving and returning the visits of his various acquaintance, and he had frequently a small and select party to dine with him at his apartments in King-street, St. James's square.

All this while, his strength declined with a rapidity which did not permit his friends to hope, that his life would long be continued. On Monday evening, Jan. 14, 1782, being with the society at Watson's, he was seized with a fit, from which he never recovered. He was accompanied home by Dr. Saunders, for whom he had the highest regard, and in whom he had, in every respect, justly placed the most unreserved confidence. The doctor afterwards attended him with unwearied assiduity, but, as to any medical purpose, entirely in vain; for he departed this life on the Friday following, in the seventy fifth year of his age, and the account of his death was received every where, in a manner which showed the high sense that was entertained of his merit. On the 7th of February, he was interred in St. James's church, with great funeral solemnity, and with a very honourable attendance of eminent and respectable friends. As a testimony of regard to his memory, at the first meeting of the college of physicians at Edinburgh, after his decease, all the members appeared in deep mourning.

Our author had acquired, by his long practice, a handsome fortune, which he disposed of with great prudence and propriety. The bulk of it, as might naturally and reasonably be expected, he bequeathed to his worthy nephew and heir, sir James Pringle, of Stichel, bart. whom he appointed his sole executor. But the whole was not immediately to come to sir James; for a sum equal, we believe, to seven hundred pounds per annum was appropriated to annuities, revertible to that gentleman at the decease of the annui-

tants. By these means sir John exhibited an important proof of his regard and affection for several of his valuable relations and friends. Sir John Pringle's eminent character as a practical physician, as well as a medical author, is so well known, and so universally acknowledged, that an enlargement upon it cannot be necessary. In the exercise of his profession he was not rapacious; being ready, on various occasions, to give his advice without pecuniary views. The turn of sir John Pringle's mind led him chiefly to the love of science, which he built on the firm basis of fact. With regard to philosophy in general, he was as averse to theory, unsupported by experiments, as he was with respect to medicine in particular. Lord Bacon was his favourite author; and to the method of investigation recommended by that great man he steadily adhered. Such being his intellectual character, it will not be thought surprising, that he had a dislike to Plato. To metaphysical disquisitions he lost all regard in the latter part of his life; and though some of his most valued friends had engaged in discussions of this kind, with very different views of things, he did not choose to revert to the studies of his youth, but contented himself with the opinions he had then formed.

Sir John Pringle had not much fondness for poetry. He had not even any distinguished relish for the immortal Shakspeare; at least, he seemed too highly sensible of the defects of that illustrious bard, to give him the proper degree of estimation. Sir John Pringle had not, in his youth neglected philological inquiries; and after having omitted them for a time, he returned to them again; so far, at least, as to endeavour to obtain a more exact knowledge of the Greek tongue, probably with a view to the better understanding the New Testament. He paid great attention to the French lan-

guage; and it is said, that he was fond of Voltaire's critical writings. How far this might contribute to the honour of sir John's taste, we shall not decide. However just that eminent Frenchman's observations may have been on some subjects of criticism, the truly ingenious and excellent Mrs. Montagu has amply shown that he was absolutely unequal to the task of determining concerning the merit of Shakspeare. Among all his other pursuits, sir John Pringle never forgot the study of the English language. This he regarded as a matter of so much consequence, that he took uncommon pains with respect to the style of his compositions; and it cannot be denied, that he excels in perspicuity, correctness, and propriety of expression. Though our author was not fond of poetry, there was a sister art for which he had a great affection; and that was music. Of this art he was not merely an admirer, but became so far a practitioner in it, as to be a performer on the violoncello, at a weekly concert given by a society of gentlemen at Edinburgh. Beside a close application to medical and philosophical science, sir John Pringle, during the latter part of his life, devoted much time to the study of divinity. This was with him a very favourite and interesting object. He corresponded frequently with Michaelis on theological subjects; and that celebrated professor addressed to him some letters on "Daniel's prophecy of the seven weeks," which sir John thought worthy of being published in this country. Accordingly he was at considerable pains, and some expense, in the publication, which appeared in 1773, under the following title: *Johannis Davidis Michaelis, Prof. Ordin. Philos. et Soc. Reg. Scient. Goettingensis Collegiæ; Epistolæ, de lxx Hebdomadibus Danielis, ad D. Johannem Pringle, Baronettum; primò privatim missæ, nunc verò utriusque consensu*

publicè editæ," 8vo. Sir John Pringle was likewise a diligent and frequent reader of sermons.

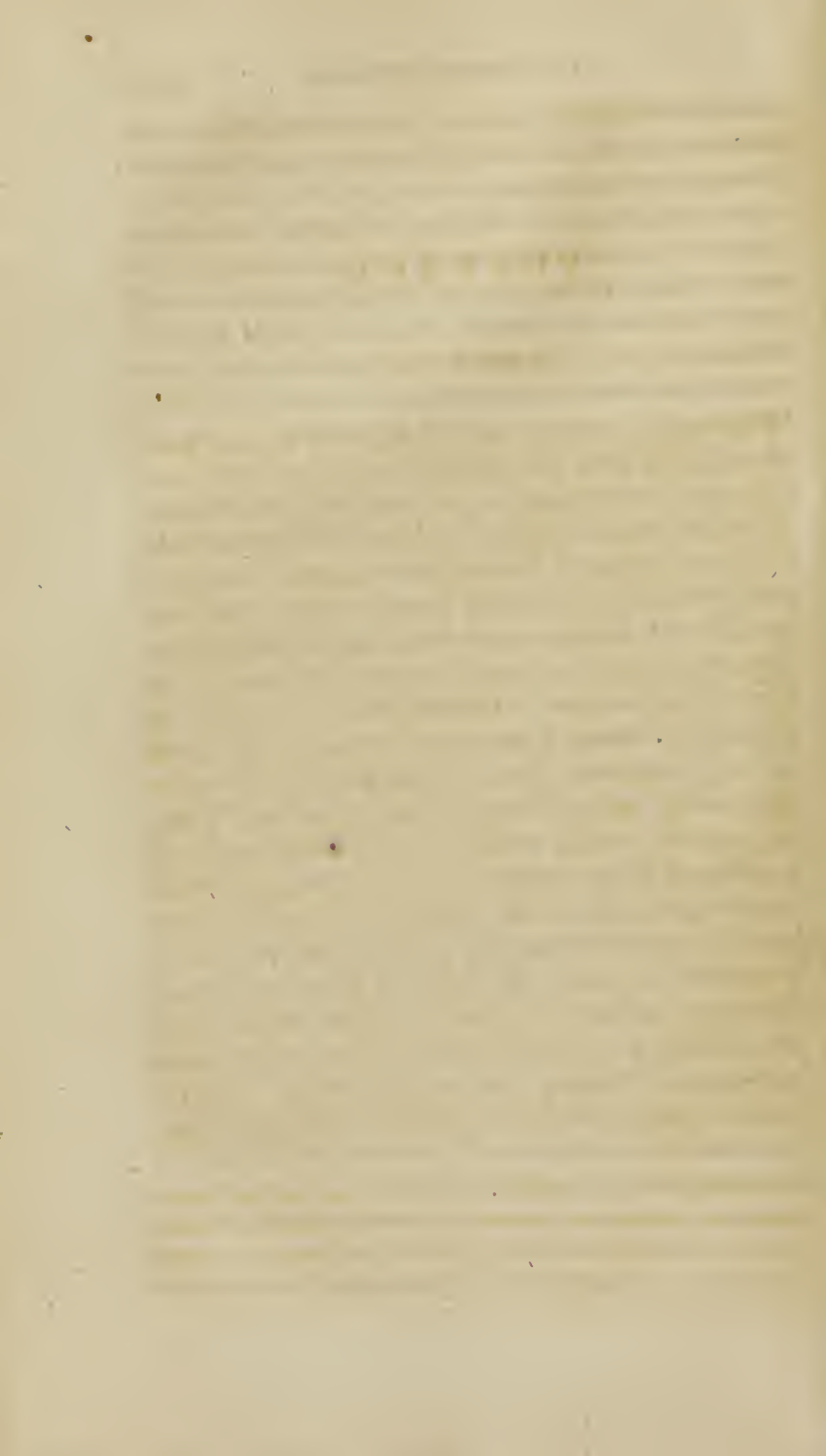
If from the intellectual we pass on to the moral character of sir John Pringle, we shall find, that the ruling feature of it was integrity. By this principle he was uniformly actuated in the whole of his behaviour. All his acquaintance will with one voice agree, that there never was an honester man. He was equally distinguished for his sobriety. He told Mr. James Boswell, that he had never in his life been intoxicated with liquor, which must be allowed to have been a very laudable proof of the circumspection maintained by him, in the variety of company that he had kept, both at home and abroad. In his friendships, Sir John Pringle was ardent and steady. The intimacies which were formed by him, in the early part of his life at Edinburgh, continued unbroken to the decease of the gentlemen with whom they were made; and were kept up by a regular correspondence, and by all the good offices that lay in his power. With relation to sir John Pringle's external manner of deportment, he paid a very respectful attention to those who were honoured with his friendship and esteem, and to such strangers as came to him well recommended. Foreigners, in particular, had great reason to be satisfied with the uncommon pains, which he took to show them every mark of civility and regard. He had however, at times, somewhat of a dryness and reserve in his behaviour, which had the appearance of coldness; and this was the case, when he was not perfectly pleased with the persons who were introduced to him, or who happened to be in his company. His sense of integrity and dignity would not permit him to adopt that false and superficial politeness, which treats all men alike, though ever so different in point of real estimation and

merit, with the same show of cordiality and kindness. He was above assuming the professions, without the reality of respect. Dr. Johnson, in his "Life of Pope," has recorded of that poet, that when he wanted to sleep, he "nodded in company;" and that he once slumbered at his own table, while the prince of Wales was talking of poetry. Sir John Pringle had this infirmity, especially in the latter part of his life. Nor is it surprising, when we consider, that he had for many years been so remarkably troubled for want of rest, that there was scarcely a single night, in which he did not lie awake for several hours.

On the religious character of sir John Pringle, it will be necessary more particularly to enlarge; because such is the temper of the present age, that what is the greatest glory of any man is often imputed to him as a weakness. The principles of piety and virtue, which were early instilled into our author by a strict education, do not appear ever to have lost their influence upon the general conduct of his life. Nevertheless, when he travelled abroad in the world, his belief of the christian revelation was so far unsettled, that he became a sceptic with regard to it, if not a professed deist. But it was not in the disposition of sir John Pringle to rest satisfied in his doubts and difficulties, with respect to a matter of such high importance. He was too great a lover of truth, not to make religion the object of his serious inquiry. As he scorned to be an implicit believer, he was equally averse to being an implicit unbeliever; which is the case of large numbers, who reject christianity with as little knowledge, and as little examination, as the most determined bigots embrace the absurdest system that ever was invented. The result of his investigation was a full conviction of the divine original and authority of the gospel. The evi-

dence of revelation appeared to him to be solid and invincible; and the nature of it to be such as demanded his warmest acceptance.

Sir John Pringle's literary and other connexions were so very numerous, that we cannot pretend to enumerate them. Of his acquaintance in England it would not be easy to give a detail. If such a detail were attempted, it would include a large number of the most worthy and eminent characters of all professions. His conversation was not confined to medical gentlemen, though his intercourse with them was very great, but extended to many persons of rank and consequence, as well as merit. It would be impossible for us to do full justice to sir John Pringle's connexions with foreigners. There were no persons who visited England, if they had any taste for philosophical science, that were not recommended to him, and did not cultivate his acquaintance. Besides this, he corresponded with many eminent philosophers and physicians whom he had never seen. Such having been the character and eminence of sir John Pringle, it was highly proper, that his name should be recorded among the worthies of Westminster Abbey. Accordingly, under the direction, and at the expense of his nephew and heir, a monument has been erected, of which Mr. Nollekens was the sculptor, and on which an English inscription appears. If it had been determined to have had a Latin inscription, there was one, written by a gentleman of the first classical knowledge and taste, which would undoubtedly have had the preference. It contained an elegant and honourable testimony to his memory.



P R E F A C E

BY THE AUTHOR.

THE diseases of the army, as far as it appears, have been treated of by none of the ancient physicians; nor have we any information about them from the historians, unless when some uncommon or very fatal distemper attended an expedition. Xenophon, in his relation of the famous retreat of the Greeks, observes, that they were liable to the *fames canina*, to blindness, and to a mortification of the extremities, from the snow and excessive cold to which they were exposed on their march. Pliny is the first who takes notice of the *stomæcace*, the distemper now called the scurvy, which afflicted the Roman army in Germany, after it had continued two years in that country.* We likewise find the Romans under a necessity of shifting their camps, on account of the noxious vapours from the adjacent marshes. Plutarch observes, that Demetrius, in his last expedition, lost above eight thousand men by a sickness which followed a scarcity of provisions. Livy mentions a pestilential distemper, that seized both the Romans and the Carthaginians in Sicily. And Diodorus describes another pestilence, attended with a

* Ancient Germany included the northern parts of the Netherlands; and it seems to be that marshy country which Pliny means; for he subjoins these words, *trans Rhenum maritimo tractu*, which agrees with the account that Tacitus gives of the expedition under Germanicus.

flux of blood, which almost utterly destroyed the latter at the siege of Syracuse; and though he refers the final cause of this calamity to the Gods, incensed against that people on account of their impiety, yet he explains the natural causes in a more full and satisfactory manner, than is usually done by historians on like occasions.

But excepting in these and a few more instances, there remains no account of the diseases incident to the armies of the ancients. It may seem strange, that Vegetius should write a chapter containing directions how to preserve the health of soldiers, and yet not mention any disorder to which they were particularly subject; and that he should speak of the physicians attending the camp, without taking notice of their manner of disposing of the sick, whether in hospitals or otherwise. The silence of the ancients upon this article is the more to be regretted, because, as war was their study, it might be expected, that the orders, relating to the care of the sick, were good in proportion to their skill in the other branches of the military art. And indeed, as their troops were almost constantly in the field, and employed in different climates, the physicians of those days had it much in their power to furnish posterity with many useful observations on the nature and causes of camp-diseases, and on the proper method of treating them. Nor, when I was first employed in the army, had this defect been supplied by any of the moderns whom I had read, unless by such as had either little, or not at all, attended the service, at least the military hospitals. So that after all, this branch of medicine, which ought long ago to have been complete, seemed to be still in a manner new: so little is a military life consistent with that state of tranquillity requisite for study and observation.

Perceiving therefore the little assistance I was to expect from books, I began to mark such observations as occurred, in hopes of finding them afterwards useful in practice. And having continued this method to the end of the former war, I was induced to put those materials into order, and, with as much clearness and conciseness as I could, to endeavour from my own experience to supply to others, in some measure, what I thought so much wanting on this subject.

I have divided the work into three parts. In the first, after a short account of the air and diseases more peculiar to the Low-Countries (so often the seat of our wars) I give an abridgment of the medical journal which I had kept of the several campaigns. In this I mention the epidemics, that is, the more frequent diseases of our troops, in the order in which they occurred; our embarkations, marches, encampments, cantonments, winter-quarters; the seasons, the changes of the weather, and, in a word, all the circumstances that seemed to me most likely to affect the health of an army. In this part I have entered but little into the description of diseases, much less have I touched upon their cure, reserving both those subjects to be treated of afterwards. My chief intention here, was to collect materials for tracing the more evident causes of military distempers, in order that whatever depended upon officers in command, and was consistent with the service, might be clearly stated, so as to suggest measures, either for preventing, or for lessening such causes in any future war. And I have been the more studious of exactness in this account, as I foresaw, that in whatever manner the whole was to be received, this part at least would be acceptable, as being a narration of facts, by one who was present and employed all the time. My inferences are few and short, as a full

discussion of those points would have too much interrupted the series of incidents, that were to be presented in this place at one view.

I have therefore thrown most of the reasoning, resulting from the first part, into the second; in which, after having divided and classed the diseases common to a military life, I inquire into the causes of them, such, I mean, as depend upon the air, the diet, and other circumstances, usually comprehended under the appellation of *non-naturals*. And here I have ventured to assign some sources of disorders, very differently from other writers upon this subject. I have also shown, how little instrumental some other causes are, which have been hitherto thought to be the most productive of military distempers. Nor will this liberty, I hope, be condemned, when the opportunities, which I have had beyond others to make such remarks, are attended to; and when it is considered, that as natural knowledge is daily improving, those who write last on subjects connected with it are most likely to be in the right.

Among the chief causes of sickness and mortality in an army, the reader will little expect that I should rank (what are intended for its health and preservation) the hospitals themselves, and that on account of the bad air, and other inconveniencies attending them. However, during the former war, one considerable step was made towards their improvement. Till then it had been usual, for the security of the sick (when the enemy was near) to remove them a great way from the camp, whereby many were actually lost before they came under the care of physicians; or, which was attended with equally bad consequences, if the hospitals were nigh, they were, for the same reason, frequently shifted, according to the motions of the army. But the

earl of Stair, my illustrious patron, being sensible of this hardship, when the army was encamped, at Aschaffenburg, proposed to the duke de Noailles (of whose humanity he was well assured) that the hospitals on both sides should be considered as sanctuaries for the sick, and mutually protected. This was readily agreed to by the French general, who took the first opportunity to show a particular regard to his engagement. For when our hospital was at Feckenheim, a village upon the Maine, at a distance from the camp, the duke de Noailles having occasion to send a detachment to another village upon the opposite bank, and apprehending that this might alarm our sick, he sent to acquaint them, that as he knew the British hospital was there, he had given express orders to his troops not to disturb them. This agreement was strictly observed on both sides during that campaign, and though it has been since neglected, yet it is still to be hoped, that on future occasions the contending parties will make it a precedent.

After having explained the general causes of sickness in armies, I proceed to point out the means of removing some of those causes, and rendering others less dangerous; for without this addition, the former observations could have been of little use. But it is easy to conceive, that the prevention of diseases cannot depend on the use of medicines, nor upon any thing which a soldier shall have in his power to neglect, but upon such orders as he himself shall not think unreasonable, and such as he must necessarily obey.

I conclude the second part with comparing the number of the sick at different seasons, that the commander may know, with some degree of certainty, what force he may at any time rely upon for service; the effects of short or long campaigns upon the health; the dif-

ference between taking the field early, and going late into winter-quarters; with other calculations founded upon such materials as were furnished by the war. The *data* are perhaps too few to deduce certain consequences from them, but as I found no other which I could depend upon, I was obliged to make the best use of these, which at least will serve for a specimen of what may be done in this way upon further experience.

These two parts being intended for the use of officers as well as physicians, I have endeavoured to relate the facts and draw my inferences in the plainest manner, and with as few scientific terms as was consistent with the nature of the subject; and, I hope, with perspicuity enough to be understood by any reader not unacquainted with the common principles of natural knowledge.

But the third part, containing the practice, is designed for those of my own profession only, as it could neither be properly explained, nor be made instructive to others. In composing this from my notes, I was long in doubt how to proceed, whether wholly to omit such things as were commonly known, or to treat all the disorders, mentioned there, in a full and regular manner. But at last I determined upon the following course. I suppose the diseases, to which an army is most subject, to be divisible into two classes; one comprehending those which are also common in Britain; and the other, such as more peculiar to a different climate, or to the condition of a soldier. Now, as the first have been fully treated of by several learned authors, in the hands of every physician, and also occur in daily practice, I pass them cursorily over, being satisfied with laying down my general method of proceeding, and marking the difference, if any, to be observed in

prescribing in military hospitals. But with regard to the other class; including what are usually called the bilious fevers, and what I have denominated the jail or hospital-fever, and the dysentery, as they are disorders less frequent in this country, I thought proper to handle them more at length, and indeed in so full a manner, as I hoped might instruct those who had been little conversant with them before.

My observations on the jail or hospital-fever were first published in the year 1750, in a letter to Dr. Mead. But as that piece was hastily written, occasioned by the jail-distemper breaking out at that time in London, some things were omitted, and some mistakes were made, which I have since endeavoured to supply and rectify in this work, wherein that dissertation is included.*

To this account of the jail or hospital-fever, as well as that of the bilious fevers, and the dysentery, I have subjoined some conjectures about their internal and more latent causes, though I am aware, that an attempt of this kind may tend rather to weaken than confirm the credit of my observations; as we too often see the judgment influenced and perverted by such speculations. But the reader may be assured, that not only the descriptions, but the treatment of all these disor-

* In the year 1722, a treatise was published here, intituled, *A Rational Inquiry into the Nature of the Plague, drawn from Historical Remarks*; by John Pringle, M. D. As the subject was similar to mine, and as the author was of the same name, the writer of the index to M. de Haller's edition of Boerhaave's *Methodus Studii Medici* has referred that piece, my letter to Dr. Mead, and my Inaugural Dissertation (at Leyden, in the year 1730) *de Marcore Senili*, to one person. In justice therefore to the worthy author of that *Inquiry*, I take this opportunity of informing the public of the mistake, which indeed it was very natural for a foreigner to fall into.

ders, were in a good measure fixed before I thought of assigning those causes, and which indeed were sometimes first suggested by the effects of the medicines. Yet a just theory would often be useful; not only for discovering more powerful remedies, but for varying those we are already acquainted with, when the judgment cannot be assisted either by mere empiricism, or even by analogy from other diseases.

In reasoning upon the nature of these distempers, I have so much recourse to the septic principle, that the reader may imagine, I have considered it as a more universal cause than I really think it; but excepting these, and one or two more I have alluded to in this work, I have hitherto referred no other disorder to that origin. As to the reality of such a principle, though I think I have sufficiently ascertained it in these sheets, yet to some it may be satisfactory to know, that the corruption of the humours, as the cause of certain diseases, was first hinted at by Hippocrates, further taken notice of by Galen, and still more fully treated of, and applied to medicine in later times, as appears by the Aphorisms of Sanctorius, and other noted works of his age. And though it was afterwards sunk in the systems of Sylvius and of Willis, as well as in that of the first mechanic writers in our art, yet it was revived by Hoffman and Boerhaave; and especially by the latter, who, under the article of *alkalis*, comprehended all that he thought septic or putrid. But as that celebrated physician had not time to ascertain every part of his doctrine from his own experience, it was no wonder that some mistakes were made, and that the extent of this principle was not fully understood.

Two things induced me to prosecute this subject; the great number of putrid cases that were under my care in the hospitals abroad, and the authority of Lord

Bacon, who offers good reasons for considering, the knowledge of what brings on, and what retards putrefaction, as most likely to account for some of the more abstruse operations of nature. My papers on this subject being read at the several meetings of the royal society, the three first were published in the Transactions; but while the rest were still in the hands of the secretary, in order likewise to be inserted there, finding it necessary to make frequent references to those experiments, I thought it proper to annex the whole to this work, in the same order wherein they were presented, with the addition of some notes, to explain what might not have been fully or clearly enough expressed before, and by way of connecting those facts with the preceding Observations.

This book was first published in the year 1752, and reprinted in the year following with some additions. In the third edition I corrected some of my observations, from further experience in the camps which I attended in England for three seasons in the beginning of the last war, before I quitted the service. But as I found the diseases of those hospitals similar to what had occurred during the former war, though milder on account of the nature of the climate, and from the soldiers not suffering the hardships, to which troops are exposed in sight of an enemy, I judged it unnecessary to give any account of those easy campaigns.

In the two subsequent editions, as well as in the present, I have revised the whole, and from more mature reflection, from my private practice, and from conversing with others who had been employed in the hospitals abroad, in different climates, during the late war, I have had an opportunity of making further improvements, by expressing with more confidence some of my former remarks, and by omitting others which

I had advanced without sufficient foundation. I have likewise added some new observations to most of the articles in the third part, and especially to the chapter on the dysentery, having had more experience in that distemper, which, though uncommon in this place, was frequent in the autumn of 1762.

I am sensible, however, that notwithstanding all my care and attention, both in making the observations and the experiments, and the repeated opportunities that I have had of revising and correcting this work, not only many inaccuracies but mistakes have escaped me, which those will most readily excuse, who, having themselves made researches of this kind, are not unacquainted with the difficulties attending their publication. Yet, however imperfect these sheets may be, I have the satisfaction to find, that they have served as a foundation for others to build upon, who, by making improvements on these subjects, have concurred with me, in attempting to draw, even from the calamities of war, some benefit to mankind.

London, 18th January, 1768.

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OBSERVATIONS
ON THE
DISEASES OF THE ARMY.

PART I.

CHAPTER I.

Of the Air and Diseases of the Low Countries.

THE river Lis rising in Artois, and joining the Scheld at Ghent, separates the high and dry part of Flanders from the low and wet. Between this line and the sea the country is flat, marshy and unhealthful, including several barrier towns belonging to the Dutch, the French, and the Austrians; of all which Furnus and Sluys are the most sickly. But the other part of Flanders being higher, is, as well as the rest of the Austrian Netherlands, a dry and healthful country.

Great part of the United Provinces, with Dutch Brabant, from Grave downwards along the Maes, being likewise low and wet, is subject to the same distempers with the flat part of Flanders. But the air is worst in Zealand, as that province is not only low and watery, but surrounded with the oozy beaches of the eastern and western Scheld, and the most marshy parts of the country; so that almost every wind, except from the sea, adds to its native moist and unwholesome exhalations.

All this tract of the Netherlands being little higher than the level of the sea, or the rivers that pass through it, was once so much exposed to inundations from floods and high tides, that till dykes and drains were made, it was one large morass; and even now, after incredible labour, the country is liable to be overflowed by extraordinary floods and other casual inlets of water. By the evaporation of this water, as well as by that of the numerous canals and ditches, in which various plants and insects die and rot, the atmosphere, during the latter part of summer and autumn, is filled with moisture, and with putrid and insalutary vapours.

A second, but less obvious source of humidity, is from the water under ground, which in that country lies so near the surface, that a dry ditch is seldom seen; and as the soil is light, the moisture easily transpires, and in summer loads the air with vapour, even where no water is visible. This is the condition of most of Dutch Brabant, where the people are more or less subject to intermitting fevers, in proportion to the distance of this water from the surface; so that by looking into their wells, one may form a judgment of the comparative healthfulness of the several villages: for these wells being fed by the subterraneous water, with which they are on a level, and sinking in proportion to the droughts of summer, are a proof of the constant exhalation of this concealed moisture, through the pores of the earth, by the heat of the sun.(1)

(1) The history of the intermitting fevers of Brabant would have been considered as an exception to the general remark, that bilious fevers are derived from putrid exhalations, had not the secret cause of them been pointed out by our author. A fever of great malignity appeared at Berbice, which, between the months of July 1804, and May 1805, carried off five hundred persons. The ground at this time was uncommonly dry, in consequence

In Zealand and upon the coast of Flanders and Brabant opposite to that province, is observed a peculiar kind of damp, rising at low water from a beach that is covered with slime and mud, and which is perhaps the more apt to corrupt on account of the mixture of the fresh with the salt water.*(2) In those parts the people are sickly; but at Ostend, which is situated upon the ocean, and where there are no marshy grounds very near, the inhabitants are in general healthy.

Another cause of the humidity and corruption of the atmosphere, is an imperfect ventilation. There are no hills to direct the wind in streams upon the lower grounds; hence the air is apt to stagnate; and the more so by reason of the large plantations made for pleasure, inclosure, or fuel. The farms and smaller villages are crowded with trees, which not only confine but moisten the air by their transpiration. But in the towns, in which there is less of this kind of moisture, where the houses and pavement of the streets in a great measure prevent the rising of the damps, and where are continual fires, the aquatic diseases are both milder and less frequent.

To these causes of fevers in flat and marshy countries, may be added the impurity of the water in common use; which being either collected from rains, preserved in cisterns, or drawn from shallow wells, is in hot and dry seasons soon corrupted. This being the case, the general tendency to putrefaction must be in-

of the absence of rain. It is most probable, this fever originated from subterraneous exhalation, such as takes place at Brabant.

* *Lancis. de Nox. Palud. Effluv. lib. i. p. i. c. v.*

(2) In every part of the United States, the exhalations from a mixture of salt and fresh water, from marshy grounds, are attended with the same effects.

creased by the use of such water, as well as by the meats, which in a close, hot and moist air are easily tainted.(3) Several circumstances therefore in that country concur in summer, not only to relax the solids, but to dispose the humours to putrefaction; and as the combination of heat and moisture is the great cause of the speedy corruption of animal substances, so it is observed in every place to produce fevers, and other distempers of a putrid kind, similar to those that occur in the low and marshy parts of the Netherlands.

This is the nature of the country. But according to the various degrees of heat and moisture of the season, the epidemic diseases begin earlier or later, are of longer or shorter duration, and are attended with milder or more alarming symptoms. When the heats come on soon, and continue throughout autumn, not moderated by winds and rains, the season proves sickly, the distempers appear early and are dangerous. But when the summer is late, or tempered by frequent showers and winds, or if the autumnal colds begin early, the diseases are few, their symptoms mild, and their cure easy.*(4)

And here it may be proper to distinguish between the moist and the rainy seasons; for in marshy grounds, intense and continued heats, even without rain, occa-

(3) There can be no doubt of the predisposition to fevers being increased by the use of impure water. This has often appeared in Philadelphia, before the general use of the water of the Schuylkill. The soil upon which the city is built, favours in many places the mixture of the unwholesome materials of many manufactories, and in some instances of the contents of privies, with pump water.

* All this is agreeable to the register of the weather and diseases, kept for several years by Dr. Stocke physician at Middelburg in Zealand.

(4) This is equally true in the middle states of America.

sion the greatest moisture, by the exhalation which they raise and support in the atmosphere; whereas frequent showers, during the hot season, cool the air, check the rise of the vapours, dilute and refresh the corrupted water, and precipitate the putrid and noxious *effluvia*.(5) But if heavy rains fall in the beginning of summer, and are followed by great and uninterrupted heats, then the water collected by the rain, stagnating in the lower grounds and corrupting there, furnishes matter for more exhalation, and thereby renders the season more sickly, and the diseases more fatal.

It ought also to be remarked, that the sickness never begins till the heats have continued long enough to give time for the putrefaction and evaporation of the water. The epidemics of this country may therefore be generally dated from the end of July, or the beginning of August, under the canicular heats; their sensible decline, about the first falling of the leaf; and their end, when the frosts begin: the rest of the year is much less disposed to produce any disease.(6)

Again, we are to observe, that though in the month of September the greatest heat of the season is past, yet the distempers continue, from the greater variations of heat and cold; for the days are still warm, but the nights are cold and damp, and often foggy; and it is by such interchanges that the perspiration is checked,

(5) This remark has too generally escaped notice, hence we confound a moist, with a rainy season. A wind often brings a moisture with it, which discovers itself in producing more obvious effects upon metals, and papers, and even wood, than a heavy rain. It likewise disposes the miasmata which produce bilious fevers to be more general, and more active in their effects upon the body.

(6) This remark applies to the bilious fevers of the middle states of America.

and the more putrescent parts of the blood retained in the body, where they produce either a fever or a flux.(7) It is also to be remembered, that the summers are hotter on the continent than in Britain; and that in the Netherlands the heats are more stifling than in hilly countries.

The epidemic of autumn, and prevailing distemper of this and other marshy countries, is a fever of an intermitting nature, commonly of a tertian form, but of a bad kind; which, in the dampest places, and worst seasons, appears as a double tertian, a remitting, a continued putrid, or even an ardent fever.* All which, however varying in their appearance, according to the difference of constitution and other circumstances, yet are of a similar nature. For though in the beginning of the epidemic, when the heats are greatest, the fevers assume an ardent and a remitting form, yet by the end of autumn they usually terminate in regular intermittents.(8)

In Zealand, where the air is worst, this fever is called the *gall-sickness*; and indeed both the redundance and depravation of the gall in this distemper are sometimes so great, that it was natural to refer the immediate cause to the corruption and overflowing of that humour.(9) But whatever be the immediate cause,

(7) The same thing has uniformly taken place in all those years, in which the bilious yellow fever has prevailed in Philadelphia, since the year 1793.

* An ardent fever is defined, part iii. ch. iv. § ii.

(8) The author in this paragraph, justly decides in favour of the unity of the cause of the bilious fever, in all its grades and forms.

(9) The bilious yellow fever, received the name of "gall sickness" from the Germans, when it first made its appearance in Philadelphia in 1793, probably from the similarity of the dis-

the disease may be continued, and the symptoms aggravated, by an increased secretion and putrefaction of the bile, occasioned by the fever. There may be in this, as in other disorders, a first cause producing an effect, and that effect producing new symptoms.

In proportion to the coolness of the season, to the height and dryness of the grounds, this fever is milder, remits or intermits more freely, and recedes further from the nature of a continued putrid, or an ardent fever. But to judge from its worse state, must we not refer most of the symptoms to a septic cause? since these fevers are commonly attended with intense heat and drought, foulness of the tongue, bitterness in the mouth, desire of acids, *nausea*, aversion to animal food, offensive vomitings, oppression about the stomach; sometimes with livid spots, and the like indications of corrupted humours. And as, with such symptoms, the disease still puts on an intermitting or a remitting form, it should seem, as if even the more benign intermittents and remittents of the season were owing, in some degree, to the same cause.

The *cholera* and the dysentery, though seldom epidemic, yet are the frequent diseases of the moister countries. They appear in the same season with the fevers, and seem to be particular determinations of the vitiated humours; to which, if the first passages give vent, a *cholera*, or a flux, ensues; but if they are retained, and carried into the blood, they produce an intermitting or a remitting fever.(10)

Both fevers and fluxes are often accompanied with worms, which are not to be considered as the cause of charges from the gall bladder, with the fever described by our author.

(10) The unity of cholera morbus, with remitting fever, is justly admitted by our author in this sentence.

either, but as a sign of the bad state of the bowels, of the corruption of the aliment, and of the weakness of the fibres of the intestines, owing to the heat, the moisture, and the putrid state of the air.(11)

These are the acute diseases of the marshy parts of the Netherlands. The chief chronical disorder is a scurvy, incident to those chiefly who live in a moist and corrupted air, and especially if they use salted meats: this, though of a milder nature, yet, as it agrees so nearly with the sea-scurvy, may be accounted the same disease. The exhalations of the canals and marshes, in hot weather, act like the steams of a foul and crowded ship; they corrupt the blood, and stop perspiration. The sea air is not the cause of the scurvy; for on board a ship, on the longest voyages, there are preservatives against the marine scurvy; and upon the sea coast, it is not in the dry and elevated parts, but in the flat and marshy, where the inhabitants suffer by that distemper.*

In general, it is the higher ranks of people who are least liable to the diseases of the marshes. For such countries require dry houses, apartments raised above the ground, moderate exercise without labour in the sun, or in the evening damps, a just quantity of fermented liquors, and victuals of good nourishment.

(11) The discharge of worms in these diseases, is the effect of the increased heat of the body, or of the want of aliment, or of the offensive nature of the medicines taken for the cure of the disease, or of all the three causes that have been mentioned. The worms are sometimes ejected by puking, as well as discharged from the lower bowels. They appear to exist inoffensively in many people, and perhaps necessarily; hence we observe them in fevers that had been preceded for months and even years, with good health.

* The nature of the scurvy is more fully explained in the Appendix, Paper vii. under experiment xlviiii.

Without such helps, not only strangers but the natives themselves are sickly, especially after hot and close summers. The hardiest constitutions are little more exempted than others, and therefore the British soldiers have always been subject to these fevers and fluxes in the Netherlands; not indeed to the scurvy, as their stay in the moister parts of the country has never been long enough to contract that disease.

Now, though in the marshy parts of Flanders and Holland, the summer and autumnal distempers are frequent and violent, yet there are few countries, however dry, that are totally exempted from them. For the heats, if great, relax the solids and tend to corrupt the humours; under which circumstances, if the body be exposed to fogs and nocturnal damps, to any stoppage of perspiration, or receives improper food, the same kind of disorders, though less characterized and less frequent, will be incident to dry as well as to marshy countries. Hence, even in the driest camps, after great and continued heats, these summer and autumnal fevers and fluxes are more or less common: for besides the natural moisture of a tent, the men will either by duty or by misconduct often suffer from wet ground, wet clothes, nocturnal damps and colds. And the danger of their falling into these diseases is the greater, as the variations of heat and cold are more sensible and frequent in the field than in quarters.

But a sudden stoppage of perspiration, coming upon relaxed fibres, and a putrescent state of the blood arising from a constant exposition to the sun, if not timely remedied, will generally occasion a remitting or an intermitting fever, a *cholera*, or a flux; so that these distempers may be considered almost as incident to a camp as to a low and marshy country.

CHAPTER II.

A general account of the Garrison Diseases of the British troops, in Flanders, and in the cantonments in Germany, in the years 1742 and 1743.

1742.] IN the beginning of June, 1742, the British troops began to embark for Flanders. There were in all, of foot and cavalry, about 16,000: the winds were favourable, the several passages short, the men landed in good health and went into their several garrisons.

The head-quarters were at Ghent, with most of the cavalry, three battalions of guards, one marching regiment, and the artillery; eight battalions were quartered at Bruges; two at Courtray; a regiment of dragoons lay at Oudenarde; and another was divided between Alost and Grammont. There was a general hospital at Ghent, but in the other garrisons, the care of the sick was committed to the surgeons of the respective regiments.

During the summer and autumn the weather was good, the heats moderate, and the country in general healthy. The British officers continued well, but many of the common men sickened; and this seems to have been the reason.

Ghent is situated between the high and the low division of Flanders; one part of the town, called St. Peter's-hill, is much higher than the rest, and in this the barracks, having drains and free air, were quite dry; so that the soldiers who lay there enjoyed perfect health. But those who were quartered in the lower part of the town (mostly on the ground-floors of waste houses, unprovided with drains, and of course damp)

were sickly. The battalion of the first regiment of guards was a remarkable instance of this difference of quarters. Two of the companies lay on St. Peter's-hill, the remaining eight in the lower part of the town, in rooms so very damp that they could scarce keep their shoes and belts from moulding. In the month of July, the sick of this battalion amounted to about 140; of which number only two men belonged to the companies on the hill, and the rest to those in the lower town. But in the middle of August, upon changing these unhealthful barracks, the sickness suddenly abated. The rest of the garison suffered much less in proportion: their highest returns at no time exceeded 70 in a battalion of foot,* and 40 in a regiment of dragoons.† Now the returns including all accidents that unfit a soldier for duty, though the above numbers were more than triple what such corps commonly have at home, yet the sickness in this garrison was accounted moderate. The highest returns were in the month of August, when the distempers were chiefly intermitting and remitting fevers, diarrhœas, and a few dysenteries.

The sickness was more considerable at Bruges, a city of the lower division of Flanders, and moister than Ghent. The soldiers had besides damper barracks. The remitting and intermitting fevers began in July; but in August the intermittents were most

* A complete battalion consisted then of 813, but after deducting the warrant-men, and the commissioned officers (who are never put into the returns of the sick) we are only to reckon this corps, when full, at about 750 private men and non-commissioned officers, whose names, upon any indisposition unfitting them for duty, are once a week (in the military term) *returned* to the commanding officer of the regiment.

† The dragoon regiments consisted of three squadrons, and each squadron of 158 men, not including commissioned officers.

numerous, which continued throughout September, diminished in October, and ceased upon the setting in of the frosts in November. These fevers were not only of a worse kind than those at Ghent, but three times more numerous, and more in proportion died. Next to the fever, fluxes were most frequent; and though not always with blood, were generally of the dysenteric kind. It was then observed, that such as lay in the upper stories enjoyed much better health than those who were below on the ground floors, which were all very damp.(12)

The two battalions at Courtray were differently lodged; one had dry barracks, the other damp; and this last had double the number of sick throughout the autumn; but their greatest return did not exceed 70. (13)

Oudenarde is in the higher division of Flanders; but the barracks being damp, having no drains, and the situation being low, the Welsh fuzileers, who lay there, suffered as much in proportion as the garrison of Bruges.

But at Alost and Grammont, towns in the same division, where the dragoons were billeted in private houses, that corps was so healthy, that when the army marched into Germany it left not a man behind.

The great number of sick, and our want of experience in the cure of diseases incident to a moist climate, were the reasons, that at this time the fevers were perhaps less successfully treated than afterwards. Many of the remittents degenerated into continued

(12) The same remark is made by Dr. Rollo in his account of the diseases of St. Lucia.

(13) The effects of moisture in rendering miasmata active in producing fevers, should never be overlooked in all our attempts to prevent them.

fevers, which were often fatal; and the intermittents by being stopped before the proper evacuations were made, or not secured against relapses, changed likewise into continued fevers, or ended in dangerous obstructions of the *viscera*.

After the frosts in November, the intermittents never appeared, unless upon catching cold; and then only such as had been ill in autumn, were subject to relapse.

Now the autumnal epidemic ceased, and the winter disorders began, which were colds in various forms. The most common were hard coughs, stitches, rheumatic pains, inflammations of the lungs, and the like; to all which, our soldiers, unused to garrison duty and cold quarters, and unprovided with clothes suited to the country, and to the season, at this time particularly sharp, were very subject.

There was no other considerable ailment except the itch, which indeed was soon after landing so general, that many believed that either the salt provisions at sea, or the change of air, must have been the cause of so sudden and extensive a complaint. But this was solely owing to the contagion of a few, who having the distemper before the embarkation, communicated it to their companions on board the ships, and in the barracks after their arrival.

These were the principal diseases of our troops before they marched. The less frequent, were dropsies and consumptions; whereof the former were the consequences of obstinate autumnal fevers ill cured; and the latter of neglected colds.

But that which was the most alarming, was a fever of a malignant nature, slow in its course, attended with a sunk pulse and a constant *stupor*: the novelty and danger, more than the number seized, made this dis-

temper considerable. The cause was at first mistaken, but afterwards it appeared to arise from the foul air in some of the wards of the hospital crowded with sick; especially in one room, in which a man lay with a mortified limb. This fever was confined to the hospital; and, as it generally begins either there, or in jails, it shall hereafter be distinguished by the name of the *jail* or *hospital-fever*.

1743.] In the beginning of February the troops moved from their winter-quarters, and marching into Germany, were cantoned in the county of Juliers, and at Aix-la-Chapelle. Only part of the cavalry was left at Brussels; and the sick and weak, to the amount of 600, being collected from all the garrisons, were put into the general hospital at Ghent. The weather being favourable, the troops entered Germany in good condition.

Soon after, the *Influenza** passed through a great part of Europe; it was sensibly felt at Brussels, though but little in the cantonments, otherwise than that many, who in the preceding autumn had been seized with agues, then relapsed. (14) As to the other disorders, they were the same as in Flanders, viz. coughs, pleurisies, and the like, from taking cold in a rigorous season.

From the arrival of the troops at their cantonments

* A short fever attended with a violent catarrh.

(14) This remark is worthy of attention. It shows that the predisposition to a disease may remain in the system long after the disease is cured. The influenza in this case, though a feeble disease, became an existing cause of agues in persons who had been cured of them the year before. Fatigue, heat, cold, and terror have the same effect. Great labour in the open air often prevents or mitigates the symptoms of influenza. To this we must ascribe its feeble impression upon the soldiers in their cantonments.

till the beginning of May, the weather was unusually cold, with much snow, that began to fall towards the end of March and continued for seventeen days; in the midst of which we left our quarters, and crossed the Rhine. The march was long, and the roads deep; but as the soldiers came every night into warm houses, and had good provisions, so few fell sick by the way, that in both marches, from Ghent to the cantonments, and from thence to the place of encampment, in winter, and in the worst weather, we did not lose twenty men.

In the beginning of May, the weather suddenly changed, and the troops, on the 17th, encamped at Hoechst, on the banks of the Main, in an open and healthful country.

CHAPTER III.

A general account of the Diseases of the British troops, during the campaign in Germany, in the year 1743; and the ensuing winter in Flanders.

1743.] **T**HE ground, though naturally good, was not yet thoroughly dry; and though the days were now warm, yet the nights were cold and condensed the vapours. These interchanges of heat and cold, joined to the moisture inseparable from tents, could not but affect the health of men unused to the field, and accordingly many were seized with inflammatory diseases.

The flying hospital was opened at Nied, a village in the neighbourhood of the camp, which in three weeks received about 250 sick. When the number was 220, the distempers were classed, and stood thus: of pleurisies and peripneumonies, 71; rheumatic pains with more or less of fever, 51; inflammatory fevers, without rheumatic, or pleuritic pains, 25; intermitents, 30; hard coughs without fever, 9; old coughs and consumptions, 7. The rest had either fluxes, or some inflammatory symptom different from these; and several slighter cases remained in the camp. The intermitting fevers and fluxes were also accompanied with a considerable degree of inflammation.

This, with little variation, is the first state of the camp-diseases; for the nights being yet cold, and the ground wet, it is easily conceived in what manner our men must suffer, who lie in tents without any covering. Besides, soldiers are often exposed to rain, and have not the means of drying their clothes: at

other times, for want of occupation, they are apt to lie down on the grass and fall asleep in the sun.

Hence the diseases, from the first encampment till past the summer solstice, are almost all inflammatory. Fluxes, remitting, and intermitting fevers, during this period have never been general, and such as have occurred have seldom been without some inflammation.

The cavalry had not near their proportion of sick, and indeed never have in camps; for the care of the horses gives the men an easy but constant employment, their cloaks keep them dry in rains, and serve for bed-clothes at night. The officers enjoyed perfect health, as they always do in the first part of a campaign.

On the 22d of June, we marched to Afchaffenburg, where the army encamped on a dry and airy field. In the hospital were left 500; so that in five weeks the proportion of the sick to the whole, was about 1 to 29. Before this motion of the troops, the sickness had sensibly decreased, and it still continued to decline in the new camp; for the weakest were already in the hospital, and the rest were somewhat inured to the field. Add, that the nights were now warm, and that there had been no rain to wet the clothes of the men, or the ground on which they lay.

On the 26th, in the evening, the tents were struck, the army marched all night, and next morning fought at Dettingen. On the night following, the men lay on the field of battle, without tents, exposed to a heavy rain; next day they marched to Hanau, where they encamped in an open field, and on good ground; but it was then wet, and for the first night or two they wanted straw. By these accidents, a sudden change was made in the health of the army. For the summer

had begun early, and the weather had been constantly hot; but the free and uninterrupted perspiration, attending those heats, had as yet prevented any general sickness. Now, the pores were suddenly stopped, and the humours tending to putrefaction were turned upon the bowels, and produced a dysentery, which continued a considerable part of the season. In the space of eight days after the battle, about 500 were seized with that distemper; and in a few weeks, near half the men were either ill, or had recovered of it. The disease was common, though not nearly so frequent among the officers; of whom those were first seized who happened to lie wet at Dettingen; the rest suffered by contagion.

The dysentery, the constant and fatal epidemic of camps, began sooner this season than it did in any succeeding campaign. Now, as the usual time of its appearance is not before the latter end of summer, or beginning of autumn, the cause has been unjustly imputed to eating fruit in excess. But the circumstances here contradict that notion; for this sickness began and raged before any fruit was in season (strawberries excepted, which, from their high price, the men never tasted) and ended about the time the grapes were ripe, which growing in open vineyards were freely eaten by every body. (15)

To this, add the following incident. Three companies of HOWARD'S, which had not joined us,

(15) Our author, in this and a subsequent part of his work, bears a just testimony against the vulgar error of the dysentery being produced by summer fruits. By their being eaten before they are perfectly ripe, or in an unsound state, or in an excessive quantity, they sometimes become the exciting cause of a dysentery originating in putrid exhalations, or they may induce, by relaxing the bowels, a predisposition to the disease.

marched with the King's baggage from Ostend to Hanau; where arriving a night or two before the battle, and having orders to stop, they encamped for the first time at a small distance from the ground that was afterwards occupied by the army. These men had never been exposed to rain, nor had lain wet; by this separation from the line, they were also removed from the contagion of the privies; and having pitched close upon the river, they had the benefit of a constant stream of fresh air. By means of such favourable circumstances, it was remarkable, that while the main body thus suffered, this little camp almost entirely escaped;* though these men breathed the same air, the contagious part excepted, used the same victuals, and drank of the same water. This immunity continued for six weeks, until the whole army removed from Hanau; when these companies joining the rest, and encamping in the line, were at last infected; but they suffered little, as the flux was then much upon the decline.

The dysentery continued all the month of July and part of August, to which the weather contributed. For soon after the above-mentioned rains, which had cooled the air, the heats returned, and for some weeks were so great, that the humours, already disposed, were farther prepared to receive the infection. Of this, the chief *fomes* seemed to be the foul straw and the privies; for as soon as we left that ground, on which we had so long encamped, the sickness visibly abated. (16)

The numbers of the sick made the symptoms

* I heard of only one man that was taken ill of the bloody flux.

(16) The fœtor from privies is a frequent cause of dysentery in the season which favours that disease, and at all seasons it is apt to induce diarrhœa.

worse, as it happens in the small pox, plague, and every other putrid and infectious disease. But the flux is particularly bad in crowded hospitals, where the corrupted steams being accumulated, are raised to a greater degree of virulence; of which fact, in this sickness, we had the following instance.

The village of Feckenheim, a league from the camp, was employed for an hospital, into which, during our stay at Hanau (besides the wounded from the field of battle) about 1500 sick were sent from the line; and of that number the greatest part was ill of the dysentery. By these men the air became so much vitiated, that not only the rest of the patients, but the apothecaries, nurses, and others employed in the hospital, with most of the inhabitants of the place were infected. To this was added a still more alarming distemper, namely the jail, or hospital-fever, the common effects of foul air from crowds and animal corruption. These two combined occasioned a great mortality in the village; while such of the men as were seized with the dysentery, and not removed from the camp, though wanting many conveniencies that others had in hospitals, kept free from this fever, and commonly recovered.

On the 16th of August, we decamped from Hanau, and came to Wisbaden, where four fresh battalions from England joined us. On the 23d, we crossed the Rhine; and on the 30th of the same month, encamped at Worms, along the river, where we remained till the 25th of September. All these encampments were on dry ground, and in an open country.

The month of August was warm and dry, without fogs; and during the rest of the autumn the weather continued fine, allowing for the abatement of heat, and the usual dews of that season. In the end of

August, though the days were still hot, yet the nights grew cool; and in the beginning of October the cold was so advanced, that the fields were covered with hoar frost in the morning.

From the time of our leaving Hanau, the dysentery so sensibly abated, that the change could only be ascribed to our leaving the infectious privies, the foul straw, and the filth of a long encampment. When the army crossed the Rhine, this distemper made but a third part of the sickness, from having been lately almost our only complaint. In a month after, it was scarce seen, unless in a few, who had been ill before, and who from imperfect cures, colds, or errors in diet relapsed into the disease.

About the middle of August, when the flux was on the decline, a new disease appeared, and daily increased as long as the troops kept the field. This was a remitting fever, the paroxysms of which came on in the evening, with great heat, drought, a violent headache, and often a *delirium*: these symptoms lasted most of the night, but abated in the morning with an imperfect sweat; sometimes with an hemorrhage of the nose, or a looseness. The stomach, from the beginning, was disordered with a *nausea* and sense of oppression, frequently with a bilious and putrid vomiting. If evacuations were either neglected, or too sparingly made, the patient fell into a continued fever, and sometimes grew yellow as in a jaundice. When the season was farther advanced, so that colds became frequent, this fever was attended with a cough, rheumatic pains and sily blood. The officers were not so subject to it as the common men, being less exposed; and for the like reason, the cavalry, who had cloaks to keep them warm in the nights, were less liable to fall ill. Others, who belonged to

the army but lay in quarters, were least of all affected; and the less in proportion to their being little exposed to heats, night-damps, and other hardships. This distemper, another common epidemic of an army, shall hereafter be distinguished by the name of the *bilious, or autumnal remitting and intermitting fever*. (17)

Both in the dysentery and in this fever, several voided round worms; a symptom that occurred in these disorders every campaign. But we are not to imagine that the worms were the cause of the fever, or of the flux*; but only that when joined to either, they made them worse. (18)

On the 25th of September, the army, free from the dysentery, but with a daily increase of the remitting fever, advanced to Spiers, but came back on the 13th of October. The weather, during this march, being cold and rainy, upon the return of the troops, above 300 hundred were sent into the hospital, and most of them ill of this disease.

Three days after, we moved to *Biberic*, and there breaking up camp, on the 25th of October, our troops in different divisions began to return to the Netherlands. The weather being favourable to the march, which continued a month, and the soldiers coming every night into good quarters, so few fell ill by the

(17) The dysentery and bilious fever originate from the same cause, and often succeed each other in the United States. It is remarkable the bilious fever, which succeeds or accompanies dysentery, is generally of a highly inflammatory or malignant nature.

* See chap. i.

(18) It would be well if physicians would attend to this remark, and not desert the indications of cure in the dysentery and bilious fever, in order to attack worms by the common remedies employed for that purpose.

way, that we arrived at our several garrisons with scarce the loss of a man.

But three thousand sick were left in Germany; part at Feckenheim near Hanau, and the rest at Osthoven and Bechtheim, two villages in the neighbourhood of Worms. The condition of those at Feckenheim has been already mentioned:* there the hospital-fever, and dysentery grew daily worse. Few escaped; for however mild or bad the flux was, for which the person was sent to the hospital, this fever almost surely supervened. (19) The petechial spots, blotches, parotids, frequent mortifications, contagion, and the great mortality sufficiently showed its pestilential nature. Of fourteen mates employed about the sick, five died; and excepting one or two, all the rest had been ill, and in danger. The hospital lost near half of the patients; but the inhabitants of the village having first received the flux, and afterwards this fever by contagion, by the two were almost entirely destroyed.

The condition of the two hospitals near Worms was better; the men had more room, they had been admitted in a cooler season, and the distempers were less putrid. But one general hospital being established at Newied, the sick were removed from their several quarters, and carried down the Rhine to that place; where, by the change of the air, those from Feckenheim were indeed at first relieved, but the rest, who

* Page 20.

(19) Exactly the same mixture not only of the dysentery, but of all other diseases with the hospital fever took place in the military hospitals of the United States during the revolutionary war, in the soldiers who were sent to them. The fever was generally the offspring of too many patients being crowded together, and of their being deprived of the means of cleanliness, and of suitable aliments and drinks.

were mixed with them, caught the infection, which the following circumstance rendered still more general and fatal. For, orders coming soon after to remove all the sick from Germany to Flanders, they were embarked in bilanders, and conveyed by water to Ghent; but where they did not arrive till the middle of December. During this voyage, the fever having acquired new force by the confinement of the air, by the mortifications, and other putrid *effluvia*, it became so virulent, that above half the number died in the boats; and several of the remainder, soon after their arrival. Its resemblance to the true plague was further evinced by this memorable incident. A parcel of old tents being sent on board the same bilanders with the men, were used by them for bedding; these tents, in order to be refitted, were put into the hands of a tradesman at Ghent, who having employed 23 Flemish journeymen about the work, lost 17 of them by the distemper, though they had no other communication with the infected. (20)

The proportion of men left in the hospitals at the end of the campaign, to those who came safe into garrison, was about 3 to 13.

The winter quarters assigned the troops, were Brussels, Ghent, Bruges, and Ostend: of these, Brussels is the highest and best aired. But in winter, as

(20) It is to be wished this fact could be inscribed in large characters over the doors of every military hospital. The hospital fever was produced during the revolutionary war of the United States, in many instances, by beds and blankets impregnated with what Dr. Miller calls idiomiasmatic or human exhalations. It was once induced by the miasmata adhering to a board partition in a hospital at the Yellow Springs in Pennsylvania, five months after it had been deserted by the patients who had infected it.

there is little exhalation, and consequently no dangerous moisture in the air, the situation of the place is then of less consequence; so that the chief concern is to have warm and dry barracks, with a sufficient allowance of fuel. The best quarters were at Brussels; and accordingly the sickness was inconsiderable there, in comparison to what it was at Ghent and Bruges, where the dampness of the barracks, concurring with some remains of the diseases of the field, occasioned frequent disorders in the beginning of winter. For though the troops returned to Flanders in apparent good health, yet, soon after their arrival, several were taken ill of the remitting fever attended with inflammatory symptoms: by which it appears, that the seeds of this fever may lie some time latent in the body, and break out upon catching cold, before the frosts have restored the tone of the bowels, braced the body, and purified the blood. (21)

In the beginning therefore of winter, these remittents were the prevailing disease of the garrisons; and next to them, jaundices without any fever. At Brussels, where the barracks were dry and warm, the fevers were few, and the jaundice uncommon; but at Ghent and Bruges, both were numerous. Yet the continuance of the fever was short; for it disappeared in December, and was succeeded by no other disorder than coughs and inflammations from colds, just as in the preceding winter.

(21) Many similar instances are to be met with in practical books of the fever, from what Dr. Miller has called koinomiasmatic or marsh exhalations being excited, long after they have been precipitated from the atmosphere by cold weather.

No epidemic appeared in the spring. The only disease, besides colds, was the contagious fever, which came from Germany, and continued in the hospital at Ghent. Some degree of the same was likewise felt in the regimental infirmaries at Bruges, which had been crowded upon our coming into quarters.

CHAPTER IV.

A general account of the Diseases of the Campaign in Flanders, in the year 1744.

1744.] THE allies first encamped at Anderlecht, within a league of Brussels, on the 13th of May; on the first of June, we moved to Berleghem, and lay there till the 31st of July, when we crossed the Scheld, encamped at Anstain, in the territory of Lisle, and there remained almost the rest of the campaign.

This year the British took the field with five new battalions, and at Berleghem we were reinforced with five more from England; which number, with the additionals to the dragoons, and with the recruits, made our national troops, in this campaign, exceed those of the former by upwards of ten thousand.

The first three days of the encampment were warm for the season, the succeeding ten were cold; but afterwards the weather becoming mild, and so continuing, with moderate heats, the summer proved very favourable for the field. Before the army passed the Scheld, there being no hard duty, and the forage being at hand, the men suffered little by wet clothes, and had no fatigue; hence the sickness was so moderate, that during the first ten weeks encampment, we sent only about 600 into the hospitals, which were at Ghent and Brussels, *viz.* not above $\frac{1}{43}$ part of the whole.

Two thirds of these disorders were merely inflammatory, being either pleurisies, peripneumonies, quinseys, rheumatisms with fever, or the like. The rest were mostly vernal agues, with a few fluxes and

other casual diseases, generally accompanied with inflammation, as in the beginning of the former campaign.*

Now, as to the inflammatory diseases of a camp, it may be proper once more to observe, that though upon first taking the field, coughs and stitches, with inflammations of the lungs and sides, are the common effects of catching cold, yet towards the summer solstice, as the weather grows warmer, the breast is less liable to be affected; so that the colds then are rather productive of a continued, or a remitting fever, with sizzly blood, than of any of the above-mentioned inflammations. It is also to be observed, that this fever, with proper management, may generally be removed in a few days; but when neglected at first, by the omission of bleeding, by the sick continuing in camp, or being carried in wagons to distant hospitals, it is never without danger. (22)

After the army came into the territory of Lisle, an hospital was opened at Tournay on the 23d of August, into which at first were sent only 50 sick; and these being all that had been taken ill since the troops crossed the Scheld, showed how healthful the camp then was. But even in this number there appeared a change in the disorders from inflammatory to putrid; as most of the cases were either remitting fevers, or dysenteries.

From the end of August to the middle of September, there fell a great deal of rain; so that the men, who went out on foraging parties, were often wet; and

* Page 17.

(22) However useful moderate gestation may be in the slow and chronic states of fever, it is certainly hurtful in all fevers of great morbid action. The editor has seen death induced by it in such cases, both in his public and private practice.

the ground whereon the foot encamped being low, retained the water. Hence, by the first of October, we had above 450 ill of the dysentery, who were sent to the hospitals; besides others, who having the same disorder in a slighter degree, were kept in the camp.

This however was the height of that distemper, which, considering the number of our troops, was not considerable, compared to its frequency in the year before. This seemed to be the reason: the weather in the beginning of the former campaign had been so hot, that, by the end of June, the humours had already acquired an acrimony; in this state, the rains at Dettingen, and the lying wet, giving a sudden check to the perspiration, many were seized at once; and from thence sprung the infection, which was increased by the hot weather, and by the privies of a long encampment on the same ground; but, by the temperature of this summer, the dysentery began late, and then could make little progress, from the coldness of the season.

The remitting fever of the camp, more regular in its appearance than the flux, began but a little later than in the preceding year, was pretty frequent in the end of September, but never so general as before. The symptoms were also milder, and there was seldom any yellowness of the skin as in the former campaign; but when the weather grew cold, this fever was often attended with a cough, infarction of the lungs, or rheumatic pains; which symptoms, as was said above,* did not properly belong to the fever, but were accessions to it from extraordinary cold.

The rains were succeeded by fine weather, which continued till the beginning of October; but this being followed by heavy and cold rains, the sickness must

* Page 21.

have increased had not the campaign ended soon after: for on the 16th some of our troops were sent into winter quarters, and in a few days they were followed by all the rest.

On breaking up, we had about 1500 sick in the hospitals at Tournay, Ghent and Brussels: this was only the 17th part of all that took the field. The number of those who died during this campaign, and in the hospitals after it, did not exceed 300. The mildness of the season, the dry encampments, the frequent exercise given to the troops by foraging parties (when the camp was fixed at Anstain) and the early retreat into winter quarters, all concurred to preserve the health of the army.

The troops returning so soon and so well into garrison, carried with them few seeds of disease. The dysentery, having been for some time on the decline, was but a little revived by the wet weather. And as half the army had been hardened by two campaigns, the remitting fever, in quarters, was chiefly confined to the recruits and new regiments, which had encamped this summer for the first time. (23)

The British returned to the same garrisons which they had left. At Brussels, the general hospital was kept up, but at Bruges and Ghent, the several regimental surgeons had orders to take care of their sick in barracks which were provided for them, and they had medicines and other necessaries at the public ex-

(23) It would seem from this fact, that habit exercises its empire over the members of a profession in which cold, heat, fatigue, labour, indolence, famine, wakefulness, danger and despotism, all conspire to produce disease. A healthy soldier would be considered as a miracle did not habit thus counteract the effects of all the remote causes of disease that have been mentioned, upon his constitution.

pense. In each of these garrisons was stationed a physician, to whom those surgeons were occasionally to apply for assistance. This scheme of separate regimental infirmaries, though only intended to save the charge of one great hospital, answered another purpose, which was that of preventing infection, the common consequence (as has been remarked) of keeping great numbers of sick together. (24)

At Ostend, remained two battalions, which having garrisoned the town during the campaign, in general enjoyed good health. The remitting fever was unknown there, and the intermittents, with some mild fluxes, were confined to the common soldiers, who by out-guards and night-duty were most exposed to cold and wet; for neither our officers, nor the people of the place, had any sickness among them.

(24) This remark is highly important, and accords with the history of the small and large hospitals of the revolutionary army of the United States.

CHAPTER V.

A general account of the Diseases of the Campaign in Flanders, in the year 1745.

1745.] ON the 25th of April, the army taking the field, encamped again at Anderlecht, and on the 9th of May advanced to Briffoel.

The weather being mild, the sickness was moderate, and of the same kind with that of our former campaigns. Inflammatory disorders were common, and, as before, mostly in the form of a pleurisy, or peripneumony; not so often in that of an acute rheumatism, as the weather was yet too cold for tempting the men to sleep on the grass, the common cause of that distemper. The vernal intermittents were also of an inflammatory kind, as were likewise the few fluxes that appeared. The small-pox was the only new disease; it came with the recruits from England, but did not spread; and indeed we have never known it of any consequence in the field.

The battle of Fontenoy was on the 11th, on which day the weather was fair, and the following night was so dry and warm, that though most of the men lay without cover, and all had been fatigued, yet no sickness ensued. (25) Next day an hospital was opened

(25) The army of the United States was generally healthy when the troops slept in the open air in *dry* weather, and still more so, when they were kept constantly in motion, from place to place. Sir Henry Clinton once complained to a loyal governor in New York, in the year 1780, that his army was very unhealthy. "An idle army, said the governor, is always unhealthy." The commander in chief supposing this remark was intended to reflect upon his neglecting to take the field against the American army, was so much offended that he avoided all intercourse with the governor afterwards.

at Ath, in the cazernes of St. Roch, which received about 600 wounded: the rest, to the amount of above 1200, were carried off by the French.

On the 16th, the army removed from Ath, and encamped at Lessines, where we continued till the 30th of June. The greatest part of May being dry, and moderately warm, was favourable both to the wounded, and to the men in camp. But June being cold and wet, the vernal agues and fluxes returned, and though little affecting the old and hardened troops, were severe on Price's and Mordaunt's regiments, which, with the draughts, were new, and had encamped at Lessines for the first time.

From this place, the army moved to Grammont, where they lay ten days, and from thence marching to Brussels, encamped on the plain of Dieghem; which being a dry, open and elevated piece of ground, is reputed the most healthful for a camp in the Netherlands. From hence, after a month's stay, we removed to Vilvorde; where the soil being still dry, the country airy, and the weather temperate, the men continued so very healthy, that in the middle of September few battalions returned above twelve sick; which was as low a number as could be expected in the best quarters.

The mildness of the weather, the dryness of the ground, and the little fatigue which the troops now underwent, concurred in making the autumn, usually a sickly season, uncommonly healthful. The dysentery had been frequent in the new regiments only, and was easily cured; nor could the remitting fever ever be called epidemic. For though it began about the end of August, and was the most frequent disease throughout the rest of the campaign, yet it was so inconsiderable, that no battalion, at any time, returned

above 7 or 8 ill of that distemper; and those with milder symptoms than had been known in the former campaigns.

It was observable, that when the army made a small remove to form a line along the great canal, the ground being low and close-planted, the effects of moisture were presently seen; but upon returning to our former camp, they soon disappeared.

On the 24th of October, the weather continuing fair and temperate, the camp broke up, and the troops went into winter-quarters. Some time before, ten battalions had been sent home; and in the beginning of November, the whole British infantry, with part of the cavalry, being recalled to suppress the rebellion, marched to Willemstad and embarked for England.

Thus far an account of the health of the main body: the state of the separate corps was as follows. In the end of August, Ostend having surrendered, the garrison, consisting of five battalions British, was conducted to Mons, where they continued about three weeks. These men had been so healthy, that when they marched out, upon the capitulation, they left only ten sick; but the same corps being put into damp barracks at Mons, whilst the town was surrounded with an inundation, the autumnal diseases so much prevailed, that in this short time 250 were taken ill, and left behind when the rest set out for Brussels. The disorders were dysenteries, remitting and intermitting fevers; and to these fevers, as is usual towards the end of autumn, were joined coughs, rheumatic pains, and other effects of cold; not without some mixture of the jail-fever, occasioned by the close and crowded barracks at Mons.

Handyside's regiment, another detached corps, came over this summer for the first time, and about the mid-

dle of July was put into the citadel of Antwerp. The air of that city is moist; the fort in particular is exposed to the exhalations of the adjacent marshes; and the barracks were on ground-floors and damp. In consequence of this, the dysentery, with remitting and intermitting fevers of a bad kind, became general among these men. In the beginning of October the sick of this battalion amounted to 183; a number five or six times greater than there was in any other corps then in the field. Such a disproportion seemed only to be owing to a greater degree of moisture; since the other new regiments, that were then in camp, suffered little; and in the town of Antwerp, fluxes, remitting and intermitting fevers were also frequent among the inhabitants, whilst the people of Brussels enjoyed perfect health. And when Ghent was taken, part of Rich's dragoons having escaped from thence and returned to Antwerp, were seized with the epidemic diseases of that place; whilst the rest of the regiment, which lay in camp, continued free both from the fevers and the flux.

Upon the whole, when the campaign ended, we had in the hospitals at Antwerp, Brussels and Mons only about 1000 sick; a small number, when we consider that during this summer there had been in Flanders, besides the cavalry, 29 battalions, whereof some had never been in the field before. From the beginning to the end of the campaign, exclusive of those who were killed in battle, or died of their wounds, the deaths did not exceed 200. The moderate heats, the dryness of the grounds for encampment, the little fatigue, and little exposition to wet and damps on marches, or other duty, and the early return to winter-quarters, were circumstances concurring to make this, of the whole war, the most healthful campaign.

CHAPTER VI.

A general account of the Diseases of the Campaign in Great Britain, 1745 and 1746.

1745.] TOWARDS the end of the campaign 1745, the three battalions of foot-guards, and seven others, embarked in Holland and landed in the south of England. The passage was short, and the troops leaving the field before the nights grew cold, arrived in perfect health. The rest of the infantry, having lain longer in camp, embarked later in the season; and being detained long on board by contrary winds, came sickly to Newcastle, Holy-island and Berwick. For some of the men, during the voyage, being taken ill of the remitting fever, this fever, by the crowds and the confined air on board, was soon converted into the jail-distemper, and became infectious.(26)

At Newcastle, an hospital was made for the sick that landed there; and the houses, taken for that purpose, receiving also those who fell ill in the army commanded by Marshal Wade, were so much crowded, that the air was soon corrupted. The fever became so contagious, that most of the nurses and medical attendants were seized with it; insomuch that three of the apothecaries of that place, with four of their apprentices and two journeymen employed in the hospital, died of it.

Ligonier's and Price's regiments landed in Holy-

(26) This fact deserves attention. A common remittent from koinomiasmatic exhalations, when it puts on a chronic form, assumes the nature of an idiomiasmatic fever, and becomes as certainly contagious as the hospital or jail-fever, from its usual cause.

island. Both had embarked in good health, after leaving their sick at Antwerp; but by the time they arrived, they were in no better condition than those who came to Newcastle. Their distress was unforeseen and unprovided for. Of 97 men taken out of the ships, ill of the jail-fever, 40 died: and the people of the place receiving the infection, in a few weeks buried 50, the sixth part of the inhabitants of that island. The same fever was carried into Berwick by the soldiers who landed there; but the sick being fewer, the distemper did not spread.

In the beginning of December, a body of troops consisting of 12 battalions and 3 regiments of cavalry, under the command of his royal highness the Duke of Cumberland, assembled at Litchfield. The Quakers had made a present of flannel under-waistcoats to the soldiers, which was a seasonable provision for a winter-campaign.(27) The march was dry; the army encamped at Packington for three days only; at Stone, the men lay for one night upon their arms: but at all other times lying in houses, and having plenty of straw, fuel, and provisions, they were more healthy than could be expected in a campaign at that time of the year.

Towards the end of December, most of the infantry were sent into quarters, whilst the cavalry and 1000 foot advanced to Carlisle. The few who fell ill on the march were left in the towns on the road to the care of the country surgeons, and were well treated.

(27) The utility of flannel waistcoats worn next to the skin, was obvious in several instances in the revolutionary army of the United States. No one of the officers who were thus clad was indisposed at the siege of Savannah, and no one of them escaped sickness who was not provided with this internal covering. The troops from Wyoming in Pennsylvania who wore flannel shirts next their skins, were rarely seen in a military hospital.

But the troops having continued several days at Litchfield, a greater number of sick was left in that place than in any other. On this account the work-house was fitted up for an hospital, where too many being admitted, the air was corrupted, and the common inflammatory fever changed into one of the jail kind, of which several died. (28) But at all other places where the soldiers were taken ill, and where there was no common hospital, this hospital or jail-fever was unknown.

The autumnal remitting fever, disguised with many symptoms of cold, could be traced in the troops that came over from Flanders, till the frosts in December put an end to it. But the prevailing disorders were hard coughs, stitches, pleuritic and rheumatic pains, with a few fluxes, the usual consequences of the men being exposed to colds and rains on duty, or to wet feet on the march. There were some intermittents besides, but all with such a mixture of coughs and infarctions of the lungs, as made bleeding the most necessary remedy. In general, bleeding was so requisite, that in every town through which the troops past, and where the sick were to be left behind, the physician of the army believed the surgeons and apothecaries of the place more than half instructed about the cure of the patients committed to them, when he had inculcated the necessity of large and repeated

(28) Uncommon mortality took place among the soldiers of the American army in the spring of 1777, from the same cause, in the house of employment in Philadelphia, which was then made use of as a military hospital. All the surgeons who attended it sickened, and three of them died from the contagion of the fever, generated wholly by too many patients being crowded together in the same wards.

bleedings; for the men were at this time well fed, and from taking cold, their blood was soon inflamed.

Carlisle was invested in the beginning of January, and taken in a few days. The shortness of the time, the mildness of the weather for the season, and the good cover which the troops found near the works, made the sickness so inconsiderable, that only one man died there. And during the whole expedition this body did not lose above 40 men, though there had been in all between 600 and 700 ill.

On the 10th of February, the army, under the command of his Royal Highness the Duke, marched from Edinburgh to Perth. It consisted of 14 battalions of foot and 3 regiments of cavalry, which being too large a number to be all billeted in the private houses of that town, two battalions were quartered in the churches. Provisions were in plenty, but the quarters were generally cold; so that many fell ill of the common inflammatory disorders of winter. The hard coughs, in particular, with pleurises and peripneumonies were most frequent.

In the beginning of March, the troops advanced from Perth to Montrose, and from thence to Aberdeen, leaving 300 sick behind, who were well accommodated in the corporation halls, or in the private houses of those towns.

Till the end of March, the whole infantry was quartered in Aberdeen; but afterwards 9 battalions were cantoned at Inverurie and Strathbogie: at this time, one battalion more landed at Aberdeen and joined the army.

The weather being all this time sharp, with frost, snow, and easterly winds, the inflammatory diseases continued. But whilst the men suffered by cold beds, guards, or out-duties, or by their own mismanage-

ment, the officers escaped, having warm quarters, and being less exposed to cold: only in the beginning of March, when the weather was very cold, a few were seized with the gout. (29)

The sick were well lodged in the town-hospital and in other large houses, where having a free air, they were preserved from the hospital-fever. Including those at Inverurie and Strathbogie, about 400 were left behind when the army moved; but of this number a small proportion died.

On the 23d of April, the army first encamped at Cullen; the next day, we passed the Spey; and on the 27th, after the battle of Culloden, we advanced to Inverness, and encamped on the south side of the town.

At Strathbogie and Inverurie, the duty had been constant to guard against a surprize; one day's march had been long and rainy, the encampment had been early, and colds had been taken by wading the rivers: these circumstances concurred to occasion some sickness. Before we reached Inverness, about 70 men being taken ill, were left in towns by the way. After our arrival, the inflammatory diseases still increased, and were the more severe, as the climate was cold, and the camp exposed in an open country to piercing

(29) We have here a striking instance of the debility which predisposes to the gout, attracting all the morbid excitement induced in the system by the exciting causes of other diseases. This law of the animal economy in its morbid state, was often exemplified during the prevalence of the yellow fever in Philadelphia, in which the usual seats of arthritic gout sometimes saved the system from the violence of the fever, but it oftener combined its symptoms with it, and thereby increased its danger and mortality.

winds. The pleurisies and peripneumonies were particularly alarming, as tending quickly to suppuration.

At Inverness, two malt-barns received the wounded; in all 270. There were several who had cuts of the broadsword, till then uncommon wounds in our hospitals; but these were easily healed, as the openings were large in proportion to the depth, as they bled much at first, and as there were no contusions and eschars, as in gunshot wounds, to obstruct a good digestion.

Besides these barns, two well aired houses were prepared for the sick. The regimental surgeons had also orders to provide quarters for their men when they were taken ill, with the liberty of sending to the general hospital such a proportion of the worst cases as would not crowd it. By this dispersion of the sick, and the preservation of a pure air in the wards, it was hoped that any contagion might be moderated, if not prevented; though it was more than ever to be apprehended, from the smallness of the town, the jails filled with prisoners, many of them wounded, the prospect of a long encampment and camp diseases, the crowds and filth of a place where the markets of an army were kept; and lastly, a morbid state of air from the measles and small-pox, which had prevailed in the town before the arrival of the army.

These circumstances concurred to put us more upon our guard, and therefore greater care was taken to divide the sick, and to keep the wards clean. An order was likewise given to clean the jails every day, to remove speedily the bodies of those who died in them; and to lessen the crowd, part of the prisoners were put on board some ships that were lying in the road, with a liberty of coming upon deck for the air.

In this manner the month of May passed without

any infection; and the weather, for the climate, being unusually dry and warm, the inflammatory sickness in the camp had visibly declined, when an unforeseen accident rendered the infectious fever more general and fatal than had been at first apprehended. For about the end of that month, Houghton's regiment, which with three more had been sent as a reinforcement, landed at Nairn and joined the army. A few days after, twelve men of that corps were sent to the hospital with fevers, and were bled largely upon admission. But next day, not observing the coughs, stitches, and rheumatic pains, the common symptoms of the fever at that time prevailing in the camp, and finding that the bleeding had sunk the pulse, and that some had an uncommon *stupor*, the physician immediately referred this fever to the contagious kind; concluding it had taken its rise from the confinement and bad air in the ships during the voyage; yet he did not understand how this battalion, and none of the rest, who sailed with it, should be so sickly.

But upon further inquiry, he was informed, that this fever came directly by infection from the true jail-distemper, communicated in the following manner. Not long before, a French ship had been taken on the coast of England, on board of which some troops had been sent to assist the rebels, and amongst them a few English soldiers, who in Flanders had gone over to the enemy. These deserters, upon being taken, were thrown into jails in England, where they were kept till the opportunity offered of sending them by the transports, to be tried by a court-martial at Inverness. They were 36 in number, and having brought with them the jail-fever, gave it to this battalion with which they happened to be embarked.

In three days after coming on shore, 6 of the

officers were seized with it, and the regiment, in the few days they were quartered at Nairn, left about 80 sick; in the ten following, while in camp at Inverness, they sent to the hospital about 120 ill of the same fever: and though the virulence of the distemper diminished afterwards in their march to Fort-Augustus, and from thence to Fort-William, yet that corps remained for some time sickly.

The symptoms of the jail-fever were in every point so like those of the hospital-fever, that, as they were formerly only conjectured to be the same distemper, they were now proved to be so. Being thus introduced, it soon spread, not only in the hospitals but among the inhabitants of the town; whilst the ordinary camp diseases, after the beginning of May, sensibly declined both in violence and number. The weather being all the month of May not only dry, but warm for the climate, the camp at this time was subject to no other diseases than such as usually attend the beginning of a campaign: there were perhaps fewer agues, and more diarrhœas. For a looseness accompanied most of the disorders, but was slight, and seemed not to be so much the effect of colds as of the river-water, which comes out of Loch-Ness, and has generally been accounted laxative to people unaccustomed to it. This looseness ceased without medicines, or soon yielded to astringents.

On the 3d of June, 4 battalions were left at Inverness, and 9, with a regiment of horse, marched to Fort-Augustus, leaving in the hospital about 600 sick, besides the wounded.

The new encampment was close by the fort at the end of Loch-Ness, in a valley surrounded by mountains, except where it opens upon the water. This lake is a large body of fresh water, twenty-four miles

in length, somewhat more than a mile broad, lying between two parallel and straight ridges of mountains, and affording the prospect of a vast canal. It is curious on account of its great depth, and its never freezing. The common soundings are from 116 to 120 fathoms, and in one place they run to 135. The water is soft and sweet, and readily bears soap; yet to some it proves laxative, and is generally diuretic. The people of the country recommend it for the scurvy; and indeed from these qualities, there is reason to believe it may be proper in some *species* of that distemper.* A great many small but heavy stones, of the marcasite kind, are found upon the beach; and it is not improbable that the bottom may be covered with the like. But whether the water is preserved from freezing by some mineral principle, by its vast depth, or by some hot springs, has not been determined.† As

* *Viz.* In scurfs, tetter, and lesser degrees of the *lepra*, which are commonly, but improperly, supposed to proceed from a scorbutic humour. See *part iii. ch. vii.*

† It is probable, that the not freezing of this lake is owing to its great depth; for Count Marsilli observes (*Hist. Phys. de la Mer*) that the sea, from 10 to 120 fathoms, is of the same degree of heat from December to the beginning of April; and he conjectures that it remains so for the rest of the year with little variation. Now, it is reasonable to believe, that the great depths in fresh water will be little more affected, than those of the sea, with the heat and coldness of the air; and therefore that the surface of Loch-Ness may be kept from freezing by the vast body of water underneath, of a degree of heat considerably greater than that of the freezing point. Another circumstance may concur: there is never any perfect calm on the lake, and the wind, blowing always from one end to the other, makes such an undulation as must much obstruct the freezing of the water. This account seems to be confirmed by an observation commonly made in the neighbourhood, which is, that when the water is taken out of the lake and kept without motion, it then freezes as soon as any other.

it is stored with good fish, and is without any particular taste, it should seem to be little, if at all, impregnated with any mineral. And besides being always cool, there is the less reason to suppose any hot springs at the bottom, as none of that kind are found any where else in the country. This lake is fed by several small rivers, which are all liable to have ice, and empties itself by the Ness, a large clear river, which after a course of six miles runs into the Frith of Murry at Inverness, and, like its source, was never known to freeze.

Fort-Augustus has always been a healthy garrison; but Fort-William, which lies towards the west coast, at the distance of twenty-eight miles from the other, has ever been sickly, and in particular subject to agues and to the bloody-flux. On the west coast there are continual rains, and the fort stands in a narrow and moist valley surrounded by mountains; so that there is not only a greater fall of rain, but a slower evaporation in that part than in any other of the country.

There being no straw at Fort-Augustus, the men were ordered to cut the heath for bedding; and it was observable, that such as were most careful in providing themselves with a due quantity, and renewing it often, were least sickly. (30)

The weather, for the last half of May and beginning of June, had been uncommonly dry and warm, but afterwards it grew cold and rainy. Upon this change, the dysentery began to be more frequent; but there being constant winds, which kept the ground tolera-

(30) The same advantage in defending the body from the dampness of the earth, has often been experienced by travellers in new and uncultivated countries, by covering the ground upon which they slept with dry leaves or with broken twigs of decayed trees.

bly dry, the increase of the distemper by contagion seemed to be thereby prevented.

The flux, and other diseases of this encampment, being attended with sizy blood, and other marks of inflammation, we found that large and repeated bleedings were more necessary here than in a warmer climate. But vomits were not so efficacious as they had been abroad, though at this time they were of more service than in the spring; as if, even in this latitude, some degree of corruption of the humours could be traced in summer.

Besides the dysentery, there were fluxes of a milder kind among the soldiers, proceeding either from errors in diet, wet feet, or wet clothes, or accompanying fevers, when, from the want of sufficient covering, the sick could not freely perspire.

The inflammatory fevers, in proportion as the summer advanced, appeared with less violent symptoms, and unless from extraordinary expositions to cold, had not so often the form of a peripneumony, pleurisy, acute rheumatism, or the like, but were chiefly distinguishable by the sizyness of the blood.

The intermittents partook both of a putrid and inflammatory nature, and therefore required both bleeding, and evacuations of the *primæ viæ*. But they were not numerous; as the constant winds prevented a stagnation of the air, and soon dried the ground after rain.

In this camp, we had no other accommodation for the sick than a few huts in the neighbourhood; apprehending therefore bad air, we sent as many as could be transported to Inverness, and by this precaution the hospital-fever was retarded but not prevented. For when the sick multiplied, these infirmary-huts were much crowded, the air was vitiated, the hospital-fever broke out and became fatal: when this was

joined to a common inflammatory disorder, a mixture of the two arose which produced some perplexing cases, from the indications of cure being so contradictory.

In the middle of August, the camp broke up, leaving at Fort-Augustus between 300 and 400 sick, who were afterwards carried to Inverness. By this time the hospital-fever was frequent among the inhabitants of that town, but was milder than usual, from the coolness of the weather and the open situation of the place.

From the middle of February, when the army crossed the Forth, to the end of the campaign, there had been in hospitals upwards of 2000 men, including the wounded; of which number near 300 died, and mostly of this contagious fever.

CHAPTER VII.

A general account of the Diseases of the Campaign in Dutch Brabant, in the years 1746 and 1747.

1746.] THIS was the state of the health of the troops in Britain. In the Low-Countries, from the beginning of this campaign, there had been only 3 battalions of foot and 9 squadrons British. In August, 4 battalions were sent from Scotland to join the army, which landing at Willemstad, and remaining some time in that low and marshy ground during the height of the sickly season, were soon afflicted with the remitting, and intermitting fevers of the country; so that before they moved, they were obliged to send many sick to the hospital at Oosterhout.

The campaign abroad being attended with several fatiguing and wet marches in autumn, after a hot summer, and continuing late, proved sickly. For at breaking up, exclusive of the wounded from the battle of Rocoux, about 1500 of our men were in hospitals, which made at that time nearly a fourth part of our whole number. But there was nothing uncommon in the diseases, being such as regularly occur in the course of every campaign*.

1747.] In the ensuing spring, 1747, the army took the field on the 23d of April, encamping first at Gilsen near Breda. Our troops consisted at first of 15 battalions of foot and 14 squadrons; and some time after, 7 battalions more arrived from England; but 4 of these

* As the author attended the army in Scotland during this campaign, he could not give a more particular account of the diseases of the troops employed in the Low Countries.

being employed in Zealand, and 3 in the lines of Bergen-op-Zoom, these 7 never joined the army.

The first days of the encampment were cold, then the weather grew mild, and continued so till the beginning of June, when it became hot. From taking the field, till towards the end of June, there was little rain, and all the camp grounds were dry.

In the first six weeks, about 250 were sent into hospitals; a moderate number, considering how early the troops had left their quarters. The distempers took their usual course, that is, were mostly inflammatory.

The battle of Laffeld was on the 2d of July, and from about that time till towards the end of the month, there fell a good deal of rain; which cooled the air. About 800 wounded were brought from the field into Maestricht, where, among other places, a large church was employed for an hospital, which not only held a considerable number, but by its spaciousness prevented the jail-fever, though many lay in it, during the season, who were ill of fluxes and other putrid diseases.

After the battle, we crossed the Maes and encamped at Richolt. In a few days we moved to Richel, and afterwards to Argenteau, still keeping in the neighbourhood of Maestricht. The situation of these camps was dry and airy, and there being at first no extraordinary night duty, the diseases were few and but little inflammatory. The dysentery did not as yet appear, unless among the guards, which at Richolt encamped on a low ground then a little wet with the rains; but the cases were few and the symptoms mild.

From the 20th of July till the 10th of September, the weather was sultry, and till the middle of August the nights were nearly as hot as the days. During all

that time the camp was healthy, but the wounded suffered; for the great heat either brought on slow fevers, or by relaxing the fibres, or rendering the humours acrid, sometimes kept the wounds from closing, and at other times disposed them, when healed, to break out afresh. About the middle of August, though the days were still hot, yet the nights began to grow cool, and the dews to fall; and from these interchanges, to which the men in camp were most exposed, the dysentery took its rise; as it usually happens upon the perspiration being checked by cold and damps, after the blood has received some taint by continued heats.

Above half the soldiers had the distemper more or less, and it was also more frequent among the officers than had been hitherto known. The contagion ran through the neighbouring villages, and was mortal among the peasants, who either wanted medicine altogether, or used what they had better been without. But Maestricht suffered little, though it had a constant intercourse with the camp; for this town standing on a large river, in an open country, is particularly well aired and clean.

Notwithstanding the violence and frequency of the flux, few of our people died of it; for the sick were more dispersed, the hospitals were better aired than usual, and the regimental surgeons having been taught by experience, either cured the men in their field-hospital, or made some necessary evacuations before they sent them to the general hospital at Maestricht.

In the beginning of October, we had much rain, and those who happened to be exposed to it were seized with the dysentery; but to the army in general, this rain was a favourable circumstance, as it cooled the

air, and thereby the sooner put an end to the disease. (31)

About this time the autumnal remitting fever, which had first appeared about the end of August, was frequent, but with nothing new either in the symptoms or cure.

In a few days after the rains, the army moved towards Breda; and as the weather began then to be cold, coughs, pleuritic stitches and rheumatic pains became common, either alone or joined to the remitting fever.

On the 12th of November, all the British got into winter-quarters.

Although there had been much sickness in the great camp during the campaign, there was little mortality; and at breaking up, considering how late in the season it was, the numbers sent from the main body into the hospital were moderate.

But in Zealand, the sickness was great among the 4 battalions which had continued there since the beginning of the campaign. These men, partly in camp and partly in cantonments, lay in South Beveland and in the island of Walcheren, two districts of that province, and both in the field and in quarters were so very sickly, that at the height of the epidemic some of these corps had but 100 men fit for duty; which was less than the seventh part of a complete battalion. The Royal, in particular, at the end of the campaign, had but four men that never had been ill. Now, the nature of the air in Zealand, and its effects in producing remitting, and intermitting fevers, and fluxes hav-

(31) The rain in this case not only cooled, but washed the air, and destroyed the putrid matters which furnished the exhalations that produced the fever.

ing been already shown, it will be sufficient to refer to that place for a general account of those distempers*; and for a more particular one, to the third part of this work.† I shall only observe here, that the epidemic fever, by reason of the great heats of the season, not only began more early in Zealand than usual, but was more severe, and fully as fatal to the natives as to us. Our officers there were also sickly; (32) though by more timely and greater care, their fevers were attended with less ardent and alarming symptoms than those among the common men. But commodore Mitchel's squadron, which lay all this time at anchor in the channel between South-Beveland and the island of Walcheren, in both which places the distemper raged, was neither afflicted with the fever nor the flux, but amidst all that sickness enjoyed perfect health; a proof, that the moist and putrid air of the marshes was dissipated, or corrected, before it could reach them; and, that a situation open to the wind is one of the best preservatives against the diseases of a neighbouring low and marshy country.

In proportion as the autumn grew cool, the fever abated of its ardour, and changed more easily into an intermittent, though irregular, and of a bad kind. The dysentery was never general, but not uncommon; and it was observable, that those who were seized with it, usually escaped the fever; or, if any man had both, it was alternately; so that when the flux began, his fever ceased, and when the former

* Chap. i.

† Ch. iv. § ii.

(32) This remark was often verified in the revolutionary army of the United States. Officers recovered from the same grade of fever which proved fatal to soldiers, from their being better accommodated and attended in private houses.

was stopped, the other returned: hence it appeared, that though the two distempers were of a different form, yet they proceeded from a like cause. (33)

As to the three other battalions which were sent to Bergen-op-Zoom, they encamped in the lines of that place, and remained there during the campaign. The town itself stands on a small eminence, but the country around being in some parts marshy, the air, though not so moist as in Zealand, was less dry than about Maestricht. The sickness was in the same proportion, being, both in kind and violence, of a middle degree between what prevailed in these two places; that is, the fevers were as much below the rage of those in Zealand, as they were above the mildness of the remitting ones of the great camp. And if the dysentery was more frequent in the lines of Bergen-op-Zoom than in Zealand, the reason was, that the men in the lines doing more duty, were oftener exposed to rain, and by being in a fixed camp had the distemper more by contagion.

At the end of the campaign, we had in hospitals, from the main body of the British troops and all detachments, exclusive of the wounded, above 4000, which was somewhat more than a fifth part of our whole number. But it is to be remarked, that the 4 Zealand battalions furnished near the half; so that when those corps went into winter-quarters, their sick, in proportion to their men fit for duty, were nearly as four to one.

(33) The truth of this paragraph, can be attested by all the physicians who have seen the autumnal diseases of the last seventeen years in Philadelphia. Where fevers do not intermit after the coming on of cold weather, they often assume a chronic and inflammatory form with a diminution of bilious discharges.

CHAPTER VIII.

A general account of the Diseases of the Campaign in Dutch Brabant, in the year 1748.

1748.] **T**HIS campaign, which was the last, opened early. For upon the 8th of April, the army encamped at Hillenraet near Roermond with 15 battalions and 14 squadrons British. From the time of our taking the field till the beginning of May, the weather was cold, with some snow, high winds, and rain; but the duty was easy, and the ground naturally dry.

On the 12th of May, the army left Hillenraet, and in a few days came to Nistleroy, where we encamped for the last time, leaving in the hospital at Cuick about 500, and those, as usual, mostly ill of inflammatory diseases. There was indeed an uncommon proportion of intermittents, which were not all recent cases, but for the most part relapses in such, as during the preceding campaign had been seized with fevers in Zealand, or in the lines of Bergen-op-Zoom. These relapses were also, from the coldness of the season, attended with some degree of inflammation.

In this camp the British were augmented by 7 battalions from England.

The weather was now warm, and the days often hot; but some seasonable rains, with thunder and lighting, seemed to prevent any sultry heats, and to purify the air of what was most insalutary. For it has been remarked of thunder, that as it is most frequent in close and marshy countries, it may have for a final cause, the cooling the air, and correcting the putrescency of the vapours when the heats are most intem-

perate.* The ground was also dry, and the camp airy; so that the sickness was inconsiderable while the troops kept the field.

From this good state of health, the 4 battalions, which had been in Zealand the last campaign, were an exception, as being subject to a relapse into irregular agues terminating in dropsies; so that their sick being numerous, and crowding the regimental infirmaries (which were in the cottages near the line) they soon bred the contagious fever, which they carried to the general hospital, then at Ravenstein. But there, the wards being spacious and well aired, though several of the sick were brought in with petechial spots, the infection spread no further.

On the 9th of July, the camp broke up and the troops went into cantonments. The head-quarters were at Eindhoven, with the 3 battalions of guards; the rest of the foot were quartered in the adjacent villages, and the cavalry near Bois-le-duc.

At this time, we had only about 1000 in all the hospitals, including such as had remained from the last winter and the preceding campaign; but in a few days after leaving the field, a fever appeared, which soon became as frequent as any that had hitherto afflicted the army. It was thus accounted for.

This part of Brabant is nearly as flat as any of the Netherlands; the only inequalities being some sand-hills and insensible risings, which give the advantage of a few feet in height to some of the villages. The soil is a barren sand, and so little water is seen, that at first sight the country might seem to be dry and healthful. But the appearance is deceitful; for water is every where to be found at the depth of two or

* Musschenbroek Instit. Phys. cap. xl.

three feet; and in proportion to its distance from the surface, the inhabitants are free from diseases. The country bordering upon the lower part of the Maes is not only unhealthful on this account, but, by reason of floods from the smaller rivers, lies all the winter under water, and continues damp throughout the summer. The moisture and corruption of the air were much increased by the inundations (which had been made about the fortified towns since the commencement of the war) and sensibly became more noxious upon letting off part of the water, in the beginning of summer, after the preliminary articles of the peace were signed. For these grounds, which were once entirely covered, being now half drained and marshy, filled the air with moist and putrid exhalations. The States of Holland being made sensible of this, by the sickness which raged at Breda and in the neighbouring villages, gave orders to let in the water again, and to keep it up till winter. (34)

This sickness was much greater near Breda and Bois-le-duc than at Eyndhoven, which lay at a greater distance from the inundations and from other marshy grounds. The moisture therefore in most of the cantonments arose principally from the subterraneous water which exhaled through the sand.* There were two villages near Eyndhoven, called Lind and Zelst, the one 10 and the other 14 feet above the surface of the water (an extraordinary height in that country) and it was observable, how much better the soldiers

(34) This wise practice should be imitated in all countries where it is practicable, in order to destroy by liquidity, the baneful effect of moisture upon grounds covered with matters capable of putrefaction.

* Chap. i. p. 2.

kept their health in both these places than in any other of the cantonments.

At Eyndhoven, two battalions of the guards were quartered in the town, and the third in the peasants' houses in the country; all within the compass of a mile; yet, it was remarkable, that the battalion, which lay out of the town, had always three times more sick in their returns than either of the other two, though one of them had been sickly the year before in Zealand. Now, the height of the ground being alike to all, the difference in point of health could be ascribed to nothing but to the greater moisture of the cottages;* for in other respects these corps were equal, *viz.* as to diet, duty and exercise. A similar case occurred in the cantonment of a regiment of foot, whereof one company being quartered in houses that stood upon a heath, enjoyed a tolerable degree of health, while the rest, that dwelt in a wood, were very sickly. And, as a further proof how prejudicial it is to confine the air by plantations, in a moist country, it was observable that the Dutch camp at Gilsen, bordering on our cantonments, but lying upon an open heath, preserved a good share of health while we were at the worst. (35)

Thus far an account of our situation; we shall next see how much the weather concurred in forming this epidemic.

The summer had been hitherto warm, but throughout July and August, whilst the sickness was greatest, the weather was fair, close and sultry. Near the inundations, the nocturnal fogs were thick and fœtid.

* Chap. i. p. 3.

(35) Our author deserves our gratitude for his reiterated notices of the bad effects of moisture, in inducing camp diseases either as a remote, or an exciting cause.

The heats abated in the beginning of September, and the distempers in proportion; but till the 20th of October, the season was never cold. About that time we had some days of rain and high winds, and towards the end of the month, some nights of hard frost; then the weather grew milder, and continued so while the troops remained in that country.

The first and worst appearance of the epidemic was in the form of an ardent fever. The men were suddenly seized with a violent headach, and frequently with a *delirium*. If sensible, they complained also of grievous pains in their back and loins, of intense thirst, and a burning heat, with sickness and oppression at the stomach, or with retchings, and vomiting of bile. Others had an evacuation of the bile by stool, with a *tenesmus*, and pains in the bowels. This fever generally remitted from the beginning, especially upon bleeding, and evacuations of the *primæ viæ*; but if these precautions were omitted, the disease went on in almost a continued form. Such was the tendency to putrefaction, that some had spots and blotches, and even mortifications, almost always fatal. (36)

With these and such other symptoms, most of the cases were accompanied, during the first rage of the distemper, in the cantonments next to the inundations; but those who lay further from the water, and were only annoyed with the natural moisture of the country and the heat of the season, had fewer and milder fevers.

Thus, though the sickness was general, those who were near the marshes suffered by far the most, both

(36) The fever described in this paragraph, accords with the second grade of bilious fever in the United States, commonly called the inflammatory bilious fever.

in the number and violence of the symptoms. The Greys, cantoned at Vucht (a village within a league of Bois-le-duc, surrounded with meadows either then under water, or but lately drained) were the most sickly. For the first fortnight, they had no sick; but after continuing five weeks in that situation, they returned about 150; after two months, 260, which was above half the regiment; and at the end of the campaign, they had in all but 30 men who had never been ill. Rothes's and Rich's dragoons, who also lay near the inundation, were likewise very sickly. Johnson's regiment of foot at Nieuland, where the meadows had been floated all winter, and were but just drained, returned sometimes above half their number. And the Scotch Fuzileers at Dinther, though lying at a greater distance from the inundations, yet being quartered in a low and moist village, had above 300 ill at one time. But it was remarkable, that a regiment of dragoons, cantoned at Helvoirt (a village lying only half a league southwest of Vucht) were in a good measure exempted from the distress of their neighbours, having remitting and intermitting fevers of a more favourable kind, and in a much smaller number. Such was the advantage of that distance from the marshes, of the wind blowing mostly from the dry grounds, and of a situation upon an open heath, somewhat higher than the rest. (37)

Thus the troops had scarce been a month in the cantonments, when the returns of the whole were increased by 2000; and afterwards they rose much higher. For the sickness continued throughout Au-

(37) The same diversity of grades appeared in the bilious fever of Philadelphia in the year 1803. It receded gradually in violence from a yellow fever in Water-street, to a mild intermittant about Tenth and Eleventh-streets from the Delaware.

gust, and only abated with the heats, in the middle of September. Then indeed the fevers began to decrease in number as well as in violence; the remissions were also more free; so that insensibly, with the coolness of the weather, this raging fever dwindled into a regular intermittent, and intirely ceased upon the approach of winter. It was curious to observe how these agues declined proportionally to the withering and fall of the leaf. At that time less moisture ascends, and by the shedding of the leaves, the vilages become more open and perflated, and of course more dry and healthful.

Throughout all the cantonments, the officers were remarkably less sickly than the common men; an advantage they owed to good beds, dry rooms, and a better diet.(38)

The peasants were great sufferers, particularly those near Breda and Bois-le-duc; but in the towns, there was less sickness, and fewer in proportion died.* In general, the fever was most frequent among the poorer sort, who lay on ground-floors, fared ill, and wanted medicine: for without artificial evacuations, nature was able either to make no cures, or but slow and imperfect ones.(39) This country had not known so much distress for a number of years; as two such causes had not concurred; I mean the inundations, with a hot and close summer and autumn.

All this while the dysentery was little frequent; a circumstance which seems to require some attention,

* This is accounted for, page 3.

(38) This was equally true in the American army, during the revolutionary war.

(39) This testimony against the power of nature, to cure acute diseases, is worthy of being placed as a motto in the title pages of all practical treatises upon medicine.

when we consider the corruption of the humours, and their disposition to affect the intestines. It may be remembered, that the flux was said to appear, when after great heats the perspiration was suddenly stopped by wet clothes, wet ground, or night-fogs and dews; but these, though common occurrences in a camp, are rare in quarters. Add, that the spreading of the dysentery is not owing so directly to the season, wet clothes, or other accidents, as to the contagion arising from the putrid excrements of those that happen to fall first ill of that distemper. Now, in the cantonments, the men were not only less liable to have their clothes wet, but when any were actually taken ill from such a cause, they were so much dispersed, that their excrements could not spread the infection.(40)

About the middle of November, the peace being concluded, the troops moved from their cantonments to Willemstad, and there embarked for England; but the wind being contrary, several of the ships lay above a month at anchor, and, after all, meeting with a tedious and stormy passage (during which the men kept mostly below deck) the air was corrupted, and produced the jail or hospital fever.

This distemper was worst in the ships which transported the sick from the general hospital (at Oosterhout) to Ipswich; for, from some seeds of the disease already among them, but chiefly from the men being crowded in the hold, where they were confined for three weeks, most of them were seized with this fever, either on board or soon after they landed. It was ob-

(40) The numerous facts related by our author, of the bad effects of the effluvia from human ordure, in inducing dysentery, whether from privies, or when exposed to the air, suggest an important lesson to the inhabitants of cities, to armies, and to private families, to guard against their morbid effects.

servable, that the greatest number, and the worst cases, were in one of the ships, in which there happened to lie two men with mortified limbs: this accident was not only the means of spreading the infection at sea, but also in the wards in which they lay after they were put ashore.(41)

The hospital, prepared at Ipswich for the reception of the sick from Oosterhout only, was obliged to admit several more from the other transports, which by stress of weather put in on that coast; so that in all, we had about 400, and most of them ill of this contagious fever. As so many were brought from the hospital-ships in the last extremity, the infection and mortality were at first considerable; but by the largeness of the wards, and by billeting in the town every man as soon as he recovered (thereby removing him from new contagion, and gaining more room for those who were still sick) the air was daily purified, and the distemper abated sooner than could have been expected. The hospital then broke up, after it had continued about three months in England.

(41) This fact shows the necessity of separating persons with mortifications or even foul ulcers, from patients in other diseases in hospitals.

OBSERVATIONS
ON THE
DISEASES OF THE ARMY.

PART II.

IN the first part, I have given a general account of the more frequent diseases of the army, as they occurred in the course of the war. But for particular descriptions, for the causes, preservatives, and cures, since they must have too much interrupted the series of facts that were proper to be presented in one view, I reserved them for different parts of this work, and shall therefore proceed in this,

- I. To divide the diseases into their several classes;
- II. To inquire into the causes, as far as they depend upon the air, diet, and other of the nonnaturals;
- III. To propose some means of prevention;
- IV. To compare the seasons, with regard to health and sickness, in order to compute what number of men may be relied on for service, at different times of the year.

CHAPTER I.

Of the Division of the Diseases most incident to an Army.

THE circumstances of soldiers, in time of war, are different from those of other people, in their being more exposed to the injuries of the weather, and always crowded together in camps, barracks, and hospitals: therefore the most general division of their distempers may be, into such as arise from the intemperance of the weather, from bad air, and from infection.

Military diseases depending on the weather are reducible to two sorts, *viz.* to those of *summer*, and to those of *winter*; or, which is the same, to those of the *camp*, and to those of *garrisons*. But as expositions to cold are unavoidable upon the first encampment, as also for some time before an army usually leaves the field, the winter-diseases, beginning about the end of autumn, do not intirely cease before the summer is well advanced; and on the other hand, as the heats of summer and the damps of autumn dispose the body to sickness, the camp-disorders do not cease intirely, but continue sometime after the troops return into winter-quarters: so that whenever we mention diseases as belonging to summer, or winter, to the camp, or garrison, they are to be understood as protracted in this manner.

If the more general diseases of an army are not to be defined by the seasons, but by the state of the body that accompanies them, we may divide them into the *inflammatory*, and the *bilious* or *putrid*; the inflammatory being the same with those of *winter*, and of

the first encampment; and the bilious or putrid, the same with those of *summer* and *autumn*, and with part of those which are carried from the field into winter-quarters.

The most frequent winter or inflammatory disorders are coughs, pleurisies, peripneumonies, acute rheumatisms, inflammations of the brain, of the bowels, and of other parts, attended with a fever; lesser inflammations, with little fever; and fevers of an inflammatory kind, where no part is so sensibly affected as to give a name to the disease. To the same class may also be referred such of the chronic ailments as arise from inflammations; whereof the chief are old coughs, consumptions, and the rheumatism without fever. Now, all these distempers come originally from colds, which are supposed to occasion a suppression of perspiration, at a time when the fibres are most braced, the blood condensed, and the pores of the skin and lungs most contracted.

But the diseases of summer and autumn are of a different nature. During these seasons, the fibres are relaxed, the fluids are more rarified, and more disposed to putrefaction; in which state, if any stoppage happen to perspiration, or to any of the excretions, designed to carry off the more volatile or putrid parts of the blood, a fever is raised, which, according to the seat of the humours, their acrimony, or the vent given them, appears in the form of a remitting, or intermitting fever, a *cholera*, or a dysentery. Hippocrates ascribed distempers of this nature to a redundance of the bile; and most authors, to a corruption of that humour; so that these summer and autumnal epidemics have been both early and generally called bilious.*

* *Putrid* would be more proper; but I have retained the ancient term *bilious*.

In effect, in all hot countries, and in camps, where men are so much exposed to the sun, the gall, if not more abundant, is at this time more disposed to corruption than usual; and this circumstance, though probably not the first cause of the fever, yet seems to be the attendant of it, and of most of the summer and autumnal disorders, and concurs to make them worse.

But when the same causes operate more slowly, or when the diseases last mentioned are but imperfectly cured, the *viscera* may be obstructed, or affected in such a manner as to give rise to various chronic complaints: so that considering not only the variety, but the frequency of disorders appearing at this time, we shall find the ancient maxim that held, “the summer and autumn to be the most sickly seasons,”* not only verified with respect to the warmer climates, but also to a camp, where men are so much exposed to heat and moisture, the great cause of putrid and contagious diseases.

Having laid down this general difference between the summer and winter diseases, it may be proper to distinguish the parts of both these seasons, in order to see their influence upon the health, according as either is more or less advanced. When the winter begins, the men being thinly clad, get coughs, pleurisies, peripneumonies, and other inflammatory complaints, from colds. The same continue throughout the spring; but as the weather is then milder, the sickness is considerably less; so that this season is of all the year the most healthful to an army. But as soon as the troops take the field, though no earlier than the first, or middle of May, by that change the winter distempers

* *Saluberrimum ver est; proxime deinde ab hoc, hyems; periculosior æstas; autumnus longe periculosissimus.* Cels. (*ex Hipp. Aphor.*) *lib. ii. cap. i.*

recur, with several intermittents and fluxes of an inflammatory kind. In the beginning of June, most of the inflammatory or winter diseases disappear, and what remain are of a milder nature: on this account, and because the autumnal epidemics have yet made no progress, this commonly proves the most healthful month of the campaign. July is likewise favourable, when the summer till that month has not been hot; and when the men have not lain in wet clothes, nor on wet ground; accidents that mostly give rise to the dysentery. But in temperate years, and upon dry ground, the diseases being milder, the remitting fevers, and fluxes begin only about the middle, or end of August, at the time when the days are still hot, but when the cool nights bring on dews and fogs. The dysentery declines with autumn, but the remitting fevers continue as long as the encampment, and never intirely cease till the frosts begin. Lastly, towards the end of the campaign, the cold weather renews many of the inflammatory symptoms; which, sometimes by themselves, but oftener combined with the remitting fever, make the first diseases of the winter.

Although this be the common course, yet we may observe, that neither the inflammatory nor the autumnal disorders are so strictly confined to their seasons, but that by various accidents they may sometimes be seen out of their place. In these matters, though there can be no precision, it is of use to know what oftenest occurs. In the year 1746, when the troops encamped in the north of Scotland, the inflammatory diseases, from the coldness of the climate, continued throughout summer; and the autumnal were either not seen, or were attended with so much inflammation, that bleeding made the greatest part of the cure.

It is to be further remarked, that as the two seasons

run insensibly into one another, there will be a mixture and confusion of the two kinds of diseases. Thus, in the end of June, or beginning of July, whilst the inflammatory symptoms recede, the bilious* are advancing; so that whatever causes bring on an illness, it may be either mildly inflammatory, or bilious, or have a mixture of the two. In the same manner, towards the decline of autumn, the bilious fevers begin to have additional coughs, stitches, rheumatic pains, or some other symptoms of the winter inflammations.(42)

Lastly, it is to be observed, that the diseases of the winter, and those of the summer differ considerably as to their cure. Thus, in all winter or inflammatory disorders, the principal intentions are to diminish the force of the blood, to relax the fibres, and to make a revulsion from the parts inflamed; on which account the lancet and blisters are the chief remedies. But in summer and autumn, while the humours are in a putrescent state, and the solids too much relaxed, such medicines are wanted as clear the first passages, correct, or expel the more corrupted parts of the fluids, and brace the fibres; hence vomits, purges, acids, and the bark are at that time of most service.

Thus far we may class the diseases depending upon the seasons, or the weather. It remains to consider such as proceed from foul air, and from contagion. The most fatal are the dysentery and the hospital-

* By this term *bilious*, I would all along mean nothing more than the remitting and intermitting fevers, and the dysentery, which are commonly attended with some corruption of the bile, without referring the first cause of these disorders to that humour.

(42) The same combination of the symptoms of winter diseases has often appeared with the autumnal bilious fever in Philadelphia.

fever, which, though arising from other causes, spread most by infection. As to the small-pox and measles, they were never general, and therefore I shall not rank them among the epidemics of an army.

The *lues Venerea* and the itch are infections of a different kind. The first, not being more incident to soldiers than to other men, I shall likewise pass over; but the latter, being so frequent in camps, barracks and hospitals, may be reckoned one of the military diseases, and as such shall be treated of in its proper place.

CHAPTER II.

Of the Causes of Diseases most incident to an Army.

IT appears from the first part, that the most frequent diseases of an army are owing either to the sensible changes in the air, and so have revolutions and periods like the seasons on which they depend; or to such accidents as are almost unavoidable in a military life: It will therefore be proper to have a thorough knowledge of both these causes, in order to find out the means for lessening their influence.

SECTION I.

Of the Diseases occasioned by Heat, and by Cold.

GREAT heats are never so much the immediate as the remoter cause of a general sickness, by relaxing the fibres and disposing the humours to putrefaction, whilst the men are the whole day exposed to the sun.* This was the case in every campaign, where it was observable, that no epidemic ever ensued upon the greatest heats till the perspiration was stopped by wet clothes, wet beds, dews or fogs, and then some bilious or putrid distemper was the consequence. In the

* Soldiers in a camp suffer much from heat, by being constantly exposed to the sun, either without any shade at all, or only covered by a thin tent; and where the air being so much confined, the heat is often more insupportable than without, in the sun. This circumstance, joined to the damps of a camp, seems to be the cause that the summer and autumnal diseases of an army, even in a northern latitude, resemble so much the epidemics of southern countries, especially of those with a moist air.

campaign of 1743, though the weather continued long hot, yet we had no great sickness till the men lay wet after the battle of Dettingen, when the dysentery immediately appeared.* Again, in the year 1747, the summer was likewise hot, but without any bad effects till towards the end of August, when the nights growing cool, the dews and night-fogs, occasioning a stoppage of perspiration, brought on the same distemper.† And in the last campaign, though the heats were great, yet they were the cause of little sickness, till the troops were cantoned in the marshes; where a considerable degree of putrefaction and moisture being joined, the ardent, remitting, and intermitting fevers, and fluxes, were only the remoter effects of that heat.‡

Nevertheless we must allow, that the heats have been sometimes so great as to prove the more immediate cause of particular disorders; as when centinels were placed without cover, or frequent reliefs, in a scorching sun; or when the troops marched, or were exercised in the heat of the day; or when the men imprudently lay down and fell asleep in the sun; all which circumstances were apt to bring on distempers varying according to the season. In the beginning of summer, such errors produce inflammatory fevers; and in the end of it, or in the beginning of autumn, a remitting fever, or a dysentery.

But cold is oftener the more immediate cause of diseases, and is hurtful two ways; either when pure, or attended with moisture; of which, the last is the worst. The disorders arising from cold weather are all of the inflammatory kind, *viz.* coughs, pleurisies, peripneumonies, rheumatic pains, and the like; together with consumptions, which in the army are almost

* Part i. chap. iii.

† Part i. chap. vii.

‡ Part i. chap. viii.

always owing to neglected colds. The mildness of our winters, and the little duty of our troops in time of peace, make expositions to cold less frequent at home. But in war, it is to be remembered what a change a soldier undergoes, from warm beds, and the landlord's fireside in England, to cold barracks, scanty fuel, and sharp winters in the Netherlands; and all this without any addition of clothes. Now, how liable our men were to take cold, was seen in the account of the first garrison sickness, and of the diseases in the beginning and end of every campaign.

SECTION II.

Of Diseases occasioned by Moisture.

MOISTURE is one of the most frequent causes of sickness. In the account of the diseases of the first winter, we observed how much the men suffered by damp barracks, especially at Bruges. The same remark was repeated in the next winter, and in the campaign of 1745. But soldiers are most liable to damps in their tents, where the air can never be thoroughly dry, by reason of a constant exhalation, and is often very moist from rains. These damps are common to all camps, and particularly to those in the lower and wetter parts of the Netherlands. But observe, that neither canals, nor even large inundations, where the water is deep, are nearly so dangerous, or exhale so much noxious vapours, as marshy grounds, or meadows that have been once floated and but lately drained; and that fields, though dry in appearance, may yet be moist by the transpiration of subterraneous water. (43)

(43) This remark is confirmed by the facts mentioned in page 2d, and should never be overlooked in our researches into the remote cause of bilious fevers.

The moisture of a season is commonly estimated by the quantity of rain, whereas it depends more on the constancy of moist winds, whether they bring great rains or none at all;* but most of all upon close weather, especially in low and woody countries. In one case, rains will cause a dangerous moisture of the air, when the water stagnates and corrupts in low grounds after land-floods; but, otherwise, in the flattest countries, if provided with drains, frequent summer showers have a salutary effect, by tempering the heat, refreshing the stagnating water, and precipitating all putrid exhalations.† It is remarkable, that pestilential diseases have frequently occurred in dry and hot summers;‡ and agreeably to this, I have observed that the most sickly seasons in the field have been attended with the greatest heat, and the least rain. (44) But it will be proper to add, that though rains in summer may be generally conducive to health, yet they have a different effect when the men are obliged to march in them, or lie upon the ground whilst it is wet with them.

* I made no experiments on the dryness and moisture of different winds in the Netherlands, but trusted to the accounts of others. Musschenbroek reckons all their northerly winds drying, but the east and northeast the dryest, and the west and southwest the moistest. *Institut. Physic. cap. xliii.* Compare Ld. Bacon's *Nat. Hist. cent. viii. exp. 786.*

† See part i. ch. i.

‡ Ld. Bacon's *Nat. Hist. cent. iv. exp. 383.* Diemerbr. de *Pest. lib. i. cap. viii.* and of this work, part iii. chap. iv. § iv.

(44) The histories of pestilential fevers in all countries prove the truth of this remark. The air in these cases is generally stagnant, or without motion. It is possible the remote cause of the fever may exist in some new mode of aggregation, or in a change of the proportions of the component parts of the atmosphere. Protracted calms at sea induce fevers, and probably from a similar cause.

Cold and moist air affecting the body, in winter produced many inflammatory disorders, and relapses into such distempers as the men had been first seized with in autumn; and this effect was still more manifest in the spring and beginning of summer, upon our first taking the field.

But the consequences of moist air, after great heats of the weather and rarefaction of the blood, are more dangerous. For moisture relaxes the fibres, as well as stops perspiration; and when the humours are so much disposed to corruption by the heat, it is not surprising that the dysentery and the bilious fever, both putrid diseases, should ensue.

The too great dryness of the air has likewise been mentioned by authors as the cause of epidemic diseases, but, I imagine, without reason. (45) For whether in winter-quarters, or in camps, the soldiers are generally exposed to too much moisture: and as for the great droughts in summer, we are not thence to infer an over dryness of the air; for as long as there are vegetables to perspire, the air will scarce ever want humidity sufficient for health; so that perhaps it is in the sandy deserts only we can learn what distempers are incident to men breathing in too dry an atmosphere.

SECTION III.

Of the Diseases arising from Putrid Air.

I SHALL next consider the putrefaction of the air, which of all the causes of sickness is perhaps the most fatal and the least understood. This bad air so hurtful

(45) A dry air, even when warm, is never unhealthy when it is changed by constant breezes. It is the "aer sine aura" of Hippocrates that produces disease.

to an army may be divided into four kinds: the first, arising from the corrupted water of marshes; the second, from human excrements lying about the camp, in hot weather, when the dysentery is frequent; the third, from straw rotting in the tents; and the fourth kind, is that which is breathed in hospitals crowded with men ill of putrid distempers. Of this sort also, but in a lesser degree, is the air of full barracks not kept clean; and of transport-ships, when the men have little room, and are long on board.

As to the first kind of bad air, it may be observed, that during the late war the whole army never happened to encamp so near the marshes as to receive any sensible harm thereby; but detachments have suffered from this cause; as one did in Zealand, another in the lines of Bergen-op-Zoom;* and in the last year of the war, a great part of the troops, being cantoned near the inundation of Bois-le-duc, became extremely sickly.† Now, as the exhalations from marshes do not consist of watery vapours only, but also of putrid *effluvia* arising from innumerable vegetables and insects that die and rot in them, it is no wonder that the distempers incident to those who breathe such air, should be of so malignant a nature; and that bilious fevers and fluxes should be so frequent, infectious and dangerous in those countries.‡

Next to marshes, the worst encampments are on low grounds close beset with trees; for the air is then not only moist and hurtful in itself, but by stagnating becomes (from the filth of the camp) more susceptible of corruption.

The second and third kinds of bad air are owing to the privies of a camp, and to rotten straw. Both these

* Part i. ch. vii. † Part i. ch. viii. ‡ Part i. ch. vii. and viii.

are always offensive; but while the bloody flux prevails, as they contain the putrid excrements, and *effluvia* of the sick, they are then more infectious and dangerous. At certain seasons, the most healthy have some disposition to the dysentery, which might go easily off, were it not for those destructive steams, that work like a ferment and ripen the disease.

The last source is from hospitals, barracks, transport-ships, and in a word from every crowded place; where the air is so pent up as not only to lose part of its vital principle by frequent respiration, but also to be subject to corruption, from the perspirable matter, which, as it is the most volatile part of the humours, it is also the most putrescent. Hence it is, that in proportion to the nastiness of such places, to the number of dysenteries, of foul sores, and especially of mortifications, the contagious fever is frequent and mortal.*

SECTION IV.

Of Diseases arising from Errors in Diet.

IRREGULARITIES in diet are commonly, but unjustly, supposed to have the greatest share in producing military diseases. Were this the case, the changes in the weather and seasons would not so sensibly affect the health of soldiers; the soberest and most regular corps would not be so sickly; different nations in the same camp, living variously, would not be afflicted with the same distempers: nor would there be such an inequality in the numbers of the sick in different years, were the greatest part of the diseases owing to any other causes, than what have been already

* This subject of *diseases arising from putrid air* will be more fully treated in part iii. chap. vii. § 6.

assigned. All therefore that can be admitted on this article, is, that there may be rules of diet established, by which, soldiers may be made somewhat less liable to sickness; but none can be proposed that will make any considerable exemption, if the weather, ground for encampment, and other circumstances do not concur to favour them.*

A soldier, in time of war, by the smallness of his pay, is secured against excess in eating, the most common error in diet. The danger is on the other hand; for when all are not obliged to eat in messes, some will be apt to spend their money upon strong liquors, and to squander away in one day their whole maintenance for a week. But when every man is obliged to contribute his share to a mess, we may be assured there can be no errors in diet of any consequence, whilst almost the whole pay is bestowed upon common food. For as to the abuse of spirits, and of fruit, and drinking bad water, however generally they have been accused, I will venture to affirm, that these three causes together never occasioned the tenth part of the sickness in the army, in any of our campaigns.

First, as to spirits, it is to be observed, that even when drunk to excess, they tend more to weaken the constitution than to produce any of the common camp diseases; or if some actually fall ill after drinking, we may be assured that many more are preserved by taking these liquors in moderation. Let us not confound the necessary use of spirits in a camp, with the vice of indulging them at home, but consider that soldiers are often to struggle with the extremes of

* This article upon diet is only to be understood as relating to men in health, and not to the sick, who ought to be under the strictest regulations of diet, depending on the hospital, and not left to themselves, or to their nurses.

heat and cold, with moist and bad air, long marches, wet clothes, and scanty provisions. Now, to enable them to undergo these hardships, it is proper that they should drink something stronger than water, or even than small-beer, which is commonly new and bad in camps, and even there too dear for their common use.

And as to fruit, another supposed cause of the camp-fever and dysentery, it must be still more innocent; since these disorders being either of an inflammatory, or a putrid nature, cannot be owing to what is acid. Were the dysentery the effect of eating too much fruit, should we not find it more common among children? Nor indeed are the soldiers overfond of it; or if they were, have they means to purchase it. We can scarce imagine, when the daily pay, after stoppages, can but just procure a pound of good meat, that a man will bestow any part of it upon fruit. A few disorderly men may rob orchards; but the dysentery and camp-fevers are diseases to which the most regular are equally subject. It may be further remarked, that our worst flux began in the end of June*, when there was no other fruit but strawberries, which the soldiers never tasted; and that the same distemper intirely ceased about the first of October, when the grapes were ripe, and so plentiful, in open vineyards, that the men eat what quantity they pleased. To these arguments, add the authority of Sydenham, who never mentions fruit as the cause of the dysenteries which were epidemic in London in his time†; and Degner, another diligent observer, and the author of a good treatise on this disease, expressly

* Part i. ch. iii.

† Op. § iv. cap. iii.

says, that fruit had no share in producing that flux which raged some years ago at Nimeguen*.

This point being then so plain, it may seem strange how a contrary opinion should have so generally gained belief, if it be not thus accounted for. The bloody flux usually coincides with that season in which fruit is in the greatest plenty; and as fruit is laxative and apt to gripe, it was natural to assign no other cause for the dysentery, than eating it immoderately; and the rather as the true cause was so little obvious. (46) But besides that strong people are little subject to a looseness from eating fruit, we may observe how different the camp-dysentery is from a common *diarrhœa*, in symptoms, danger, and cure. It may be allowed, that eating too much fruit disposes the body to agues, especially in a moist country; but the remitting fever of the camp is not only of a more putrid nature, but is mostly attended with a sensible inflammation. But granting that fruit is capable of producing both fevers and fluxes, such as prevail in an army, yet in some hundreds which have been under my care for these distempers, as I never, upon the strictest inquiry, could discover this to be the cause, I must conclude that it so rarely takes place, that we may omit it in the account. At the same time it will be proper to observe, that whoever is actually under the cure of a flux, or but lately recovered, should be cautious with regard to fruit; for though the acid may

* Hfst. Dysent. cap. ii. § xxx.

(46) Accidental coincidence is a fruitful source of error in medicine, as well as in other things. The arrival of two or three vessels from the West Indies in the month of August, and the appearance of the yellow fever, at the same time, have thus been combined, as cause and effect, in several of the seaports of the United States. They are as unrelated as the ripe summer fruits and dysentery in the cases mentioned by our author.

be good for correcting the disposition to putrefaction, yet the bowels may be too much relaxed, and in too tender a state to bear any sharp, cold, or flatulent aliment. For the same reason, those who have lately recovered of intermittents must forbear eating it, or use it moderately. Nor should the most healthy person eat freely of it in close and marshy countries; because whatever is of so cooling and relaxing a nature, may too much weaken the habit, and thereby check perspiration; by which means fruit, though in itself antiseptic, may yet lay the foundation of some putrid disease.

Lastly, that many diseases are owing to bad water, has been an ancient and prevailing opinion; and even Hippocrates refers various disorders to this cause. But without entering into an inquiry about the justness of those notions, I shall only remark, that we are not to apply what is said of the water in the country where that author practised, to what our army commonly drank, which was plentiful and good. The only exception worth notice was in Zealand, where the water being indeed less pure, it might concur with other causes in making the sickness more general in that province.* But in all other places our water was blameless, and particularly in the two seasons during which the bloody-flux was most epidemic.†

To conclude, whoever will peruse the account of the several campaigns, will see such an uniformity in the rise and periods of the diseases, and that so much connected with the state of the air, as will be sufficient to convince him, that neither the abuse of spirits, nor of fruit, nor drinking bad water, could have any considerable share in producing them.

* Part i. chap. i. and vii.

† *Viz.* In the camp at Hanau, in the year 1743; and at Maestricht, 1747. See part i. chap. iii. and vii.

SECTION V.

Of Diseases arising from excess of Rest, and Motion; of Sleeping, and Watching; and from want of Cleanliness.

THE life of a foot-soldier is divided between the two extremes of labour and inactivity. Sometimes he is ready to sink under fatigue, when having his arms, accoutrements and knapsack to carry, he is obliged to make long marches, especially in hot or rainy weather; though the most frequent errors of men of that rank are on the side of rest. But the cavalry lead a more uniform life, having little fatigue by marches, and a constant but easy exercise, both in the field and in quarters, in the care of their horses; one reason for their better health.

Sometimes the service requires such frequent returns of duty, that the men have not time to sleep; but such occurrences are rare, and generally when soldiers are off duty they sleep too much, which enervates the body, and renders it more subject to diseases.

It is well known how necessary it is to keep up the perspiration; and also, how much the uncleanness of the person will concur with other things to frustrate that intention. I have observed in the hospitals, that when men were brought in from the camp with fevers, nothing so much promoted a *diaphoresis*, as washing their feet and hands, and sometimes their whole body, with warm water and vinegar, and giving them clean linen. So that officers judge rightly with respect to the health of the men, as well as to their appearance, when they strictly require cleanness in their persons and clothes.

Under this head, it will be proper to mention the itch, the most general distemper among soldiers. The itch spreads so easily by the contact of the foul person, or of his clothes, that one in the same tent, mess, or barrack, will often communicate it to the rest: this circumstance, joined to the little attention which men of that rank have to cleanliness, makes it difficult to keep it under, though the cure of each individual be generally easy.

CHAPTER III.

Of the General Means of preventing Diseases in an Army.

ALTHOUGH most of the causes of diseases above enumerated, *viz.* excess of heat and cold, too much moisture in the air, a putrid state of the air, great fatigue, wet clothes, and other circumstances which can hardly be avoided, in times of actual service; yet as these only dispose men to sickness, and do not necessarily bring it on, it is incumbent on those who have the command, to make such provision as shall enable the soldier to withstand most of the hardships incident to a military life. It is almost needless to add, that the preservatives from diseases are not to depend on medicines, nor on any thing which a soldier shall have in his power to neglect; but upon such orders only, as, at the same time that they do not appear unreasonable to him, he shall be obliged to obey.

We shall therefore inquire into the means of preservation from sickness in the order of its causes before-mentioned;* and as the chief depends on the air, we shall consider the proper precautions to be used in regard to it; and shall next propose some regulations about the diet, and other points that may fall under the direction of the officers.

SECTION I.

How to prevent Diseases arising from Heat, and Cold.

TO palliate the effects of intemperate heat, commanders have found it expedient so to direct the

* Chap. ii.

marches, that the men should come to their ground before the heat of the day; and to give orders, that none of them sleep out of their tents,(47) which in fixed encampments may be covered with boughs; to shade them from the sun.* It is a rule of some importance, to have the soldiers early out, and exercised before the cool of the morning is passed; for by that means not only the sultry heats are avoided, but the blood being cooled, and the fibres braced, the body will be better prepared to bear the heat of the day. Lastly, in hot weather, it will be found proper to shorten the centinel-duty, whenever the men are to stand without any shade.

The preservatives from cold consist of clothes, bedding, and fuel. The experience which we have had of the use of under waistcoats, during the winter-campaign in Great-Britain,† should teach us to make the same provision for the whole army in any future war. None of the foreign soldiers are without this necessary part of clothing; and indeed no man of the meanest condition abroad. Under-waistcoats would not only be useful in winter-quarters, but greatly so, on first taking the field, and towards the end of the campaign. How much likewise watch-coats were wanted for centinel-duty, appeared from the general account of the diseases during the first winter. Another article, is the provision of strong shoes; for it is well known how easily men catch cold by wet feet.

(47) For reasons given in a former note, it has been found that soldiers suffer less from sleeping in the open air, than in tents with the usual number of persons allotted to each of them.

* *Ne aridis, et sine opacitate arborum, campis aut collibus, ne sine tentoriis æstate, milites commorentur. VEGET. de Re Milit. lib. iii. cap. ii.*

† Part i. chap. vi.

The second means of preservation mentioned was bedding, by which is understood, a blanket for every tent of the infantry. This provision, regarded by other nations, has generally been neglected both by the French and our army. We have observed of what advantage the cloaks were to the cavalry; how useful therefore blankets must be in preserving the health of the foot, in the beginning and end of a campaign, is obvious. The only point to be considered, is, whether the expense, and impediment of so much baggage, will overbalance that advantage.*

The last preservative was fuel. Of this our soldiers might require a greater supply, as being of military people the least inured to cold; but, as bearing some degree of it in winter quarters may tend to harden them against an early campaign, all that is requisite, is to give them enough for dressing their victuals, correcting the dampness of their barracks, and the rigour of a severe winter; and to trust rather to their warmer clothes, and exercises, than to fire, for preventing diseases arising from cold. We find these two articles of clothes and fuel particularly recommended to the care of commanding officers by Vegetius, an ancient who has given one of the fullest accounts of the Roman discipline.†

SECTION II.

How to prevent Diseases arising from Moisture.

WHEN troops are to go into garrison, it is the business of the quarter-masters to examine every bar-

* Since the first edition of this work, all our foot upon service have been provided with blankets.

† Non lignorum patiantur (milites) inopiam, aut minor illis vestium suppetat copia; nec sanitati enim nec expeditioni idoneus miles est, qui algere compellitur. *De Re Milit. lib. iii. cap. ii.*

rack offered by the magistrates of the place, and to refuse the ground-floors in houses, which either have been uninhabited, or have any signs of moisture. (48) We had an instance of the comparative dryness of upper stories,* which are always preferable, and particularly in the Netherlands, where the houses are without drains. But if dry habitations cannot be procured, the chief prevention of sickness from moisture will then depend upon fuel.

In the field, the best security is by making trenches around the tents; by which means not only the natural moisture of the ground is lessened, but the rain-water is intercepted and carried off without wetting the straw. This is necessary though the camp be to remain but for a few days in the same place.

It is of much importance to allow soldiers plenty of straw, and to have it often renewed; for a dry and fresh bedding is not only comfortable, but a preservative against diseases, and one reason of the better health which an army enjoys upon shifting ground, as the damp, or rotten straw is then left behind. But in fixed camps, when the straw is not often enough changed, it will be proper to have the tents opened every day for some hours, and once in a few days, to have all the straw taken out and well aired: without this precaution it will not only grow damp, but soon rot and prove unwholesome.

(48) It is possible this remark may be correct in the damp countries, in which our author exercised his profession; but in the United States, ground floors were found to be uniformly more healthy, especially for hospitals, than any others. The fact is taken notice of by count Saxe in his reveries, and was mentioned by col. Ward of the Massachussetts's troops to Dr. Tilton, who applied it with great success to the construction of military hospitals for the revolutionary army of the United States.

* Part i. chap. ii. *See also the notes on the*

to be more correct than the

original

It will also be necessary for the officers to air their tents daily; if this be not attended to, every thing will contract moisture. They are further to be advised, not to lay their matrass upon the grass, but to raise their bedding from the ground, or to use a bedstead. Oil-cloths spread on the ground of the tent, and kept dry, intercept much of the rising vapour. Towards the end of the season, when the weather grows cold and damp, it will be found useful to burn spirits in the evening, in order to warm and correct the air in the tent. But at no time are the officers to confine the air too much, not even in cold weather, and especially when sick; taking it for a rule, that there is more danger in lying in a moist atmosphere, loaded with their own *effluvia*, than with the curtains of the tent open, under a close marquise.

Soldiers are unavoidably exposed to rain on marches and out-duty, and upon getting wet clothes are liable to fall sick, unless they be allowed to cut down wood to burn in the rear of the camp; an indulgence which I have observed to be necessary on those occasions.

Where the grounds are equally dry, the camps are most healthful on the banks of large rivers; because in the hot season, those situations have the advantage of fresh air from the water, to carry off both the moist and putrid exhalations. And in cantonments, we are not only to seek villages removed from marshy grounds, but such as are least shut up with trees, and stand highest above the subterraneous water. In moist countries, towns are preferable to villages, and to single dwellings, for the reasons already given.*

* Part i. chap. i. and viii.

SECTION III.

How to prevent Diseases arising from Putrid Air.

HAVING in the last chapter enumerated the common sources of putrid air which affect an army, I shall now offer a few considerations upon the means for removing, or lessening each in particular.

First, with regard to the putrid air of marshes and other stagnating water, the preservatives mentioned under the article of moist air are in a good measure applicable here. If the military operations shall oblige an army to continue long upon such ground, the best expedient will be to make frequent removes;* for by shifting, the straw will be changed, the men will have more exercise, and the old privies will be left behind, which in camps are particularly noxious on account of the frequency of the dysentery.

As to cantonments in marshy grounds, if the troops must remain there in the dangerous season, it will be better to float the fields intirely, than to leave them half dry; for the shallower the water is, the more it will corrupt, and the evaporation will be greater in proportion. (49) The regiment at Helvoirt, which lay off the inundation about half a league only, was an instance how near troops may be to marshes

* Si autumnali æstivoque tempore diutius in iisdem locis militum multitudo consistat, ex contagione aquarum et odoris ipsius fœditate, vitiatis haustibus, et aëre corrupto, perniciosissimus nascitur morbus, qui prohiberi aliter non potest nisi frequenti mutatione castrorum. VEGET. *de Re Milit. lib. iii. cap. ii.*

(49) The practice here recommended is wise, and should be followed in all cases where it is practicable. The certainty of its good effects is evinced by those low countries in the United States, which are sickly in ordinary seasons, being uncommonly healthy in those seasons in which the low or marshy grounds are covered by an unusual quantity of rain.

without any remarkable sickness;* at least if the wind should carry the vapours a different way. Commodore Mitchel's squadron in Zealand, and the healthy cantonments at Eyndhoven, Lind and Zelst, in a sickly neighbourhood, afford more instances of the same nature.† Nay it has been observed that in Rome, the sphere of noxious vapours, from the adjacent marshes, has extended to those streets only which lay nearest them, occasioning bad fevers there, whilst the rest of the city was healthful.‡ Thus, sometimes a small remove from the marshes may prevent a general sickness. But if moving be inconsistent with the service, as it happened in the campaign 1747, when some battalions were sent to Zealand, and in the summer following, when our troops were cantoned among the inundations, we must be content to lessen those evils which cannot wholly be avoided. As this is chiefly to be done by diet and exercise, we shall propose the rules when we come to treat of those articles.

Whenever the dysentery begins to spread, the best means of preserving health are to leave the ground, with the privies, foul straw and other filth of the camp; which method is to be repeated once or twice more, or oftner, if consistent with the military operations; or at least till the middle of September, when the danger is in a great measure at an end. The first campaign furnished a good argument for this practice; for the long continuance on the same ground, at Hanau, kept up the rage of the dysentery, which,

* Part i. chap. viii. .

† Part i. chap. vii. and chap. viii.

‡ LANCIS. de Nox. Palud. Effluv. lib. ii. epid. i. cap. iii.

upon decamping, suddenly abated.* And in the year 1745, the flux was milder than ever we have known it, which we impute not only to the coolness of the season, but also to the frequent removes, during the time that the army was most liable to the disease.† But if any circumstance should make it improper to change the ground when the dysentery begins to spread, other methods must be taken to check its progress.

In order therefore to preserve a purity of air in the dysenteric season, let there be some slight penalty, but strictly inflicted, upon every man that shall ease himself any where about the camp, but in the privies. Further, from the middle of July, or upon the appearance of a spreading flux, let the privies be made deeper than usual, and once a day a thick layer of earth thrown into them, till the pits are full, which are then to be well covered, and supplied by others. It may also be proper to order the pits to be made either in the front or rear, as the reigning wind of the season may best carry off their *effluvia* from the camp. Moreover it will be necessary, frequently to change the straw, as not only apt to rot, but to retain the infectious steams of those who have fallen ill of the disease. But if fresh straw cannot be procured, more care must be taken in airing the tents and the old straw, as before directed. (50)

Lastly, when the dysentery begins to be frequent,

* Part i. chap. iii.

† Part i. chap. v.

(50) The whole of this paragraph merits attention. The important advice contained in it will never produce its full effects upon the health of armies, until the commanders of them make a physician a part of their families, and regulate their encampments, as well as every thing else connected with health, wholly by their advice.

the sick should not be sent to one common hospital; at least not in such numbers as may vitiate the air so as not only to communicate the infection to others, but to keep it up among themselves. This rule will be much enforced by attending to the facts mentioned in the account of the German campaign,* compared with what passed in the summer 1747.† Therefore when the dysentery prevails, the regimental surgeons are to treat the slighter cases in the camp itself; and as many of the rest as they can conveniently attend or accommodate, in the regimental hospitals, which are then particularly to be chosen spacious and airy. Barns, (51) granaries, and the like places, will allow the steams to disperse, without any danger from cold, as the weather is usually warm during that time. As to the general hospital, let it receive such only as the regimental hospitals cannot accommodate, and the sick that cannot be moved with the army. Without this dispersion of the men, the great hospital may, in sickly times, be charged with some thousands, who cannot be well attended, but by a greater number of physicians than has hitherto been employed by the public. But were this objection removed, it would be still unadvisable to have but one general hospital, on account of the mortality that usually ensues upon crowding together a number of putrid and contagious diseases.

Having, in the account of almost every campaign, mentioned the frequency of the hospital-fever, I need not now urge the necessity of using precautions against it. Without entering upon a particular account

* Part i. chap. iii.

† Ibid. chap. vii.

(51) The editor can testify from experience to the advantages of barns, for military summer hospitals, in preference to any other buildings.

of its nature, which is reserved for the third part of this work, I shall at present only propose the means whereby this disease may be kept either from appearing at all, or, at least, with so much contagion and danger. These means shall be considered under two heads; one, relating to the choice of hospitals; and the other, to the management of the air therein.

In treating of the bloody-flux, the most airy and spacious houses, to be procured in the neighbourhood of the camp, were recommended, for the better recovery of the sick, and for guarding against infection. Now the same means will also tend to prevent the hospital-fever, as the dysentery is so apt to breed it.* On these occasions, it is common to look out for close and warm houses, and therefore to prefer a peasant's house to his barn; but experience has convinced us, that air more than warmth is requisite. For this reason, not only barns, stables, granaries and other out-houses, but, above all, churches make the best hospitals, from the beginning of June till October. Of this there was an instance in the campaign of 1747, when a large church at Maestricht was applied to that use; and where, notwithstanding above 100 lay in it, with foul sores, fluxes, and other putrid diseases, for three months together (during the greatest part of which time the weather was hot) this fever never ap-

* The putrid *effluvia* of the dysenteric *faeces* are not only apt to propagate the dysentery, but likewise to breed the jail or hospital-fever, with, or without bloody stools. (52)

(52) This remark proves that the exhalations from dysenteric *faeces* do not act specifically in inducing dysentery, but that they are upon a footing with exhalations from other putrid matters. It is probable the original fever thus produced by them was the bilious fever, and that the jail or hospital-fever was combined with it.

peared.* (53) Therefore we may lay it down for a maxim, that the more fresh air we let into hospitals, the less danger there will be of breeding the contagious distemper.

Another point to be observed in a fixed camp, is to have the regimental hospitals scattered, and not crowded into one village. And for the same reason, if it should be necessary for the general hospital to admit a great number at a time (which must frequently be the case, upon the motion of an army after a long encampment) it will be proper to have the sick dispersed into two or three villages, rather than kept in one; though a narrower compass may be more for the economy of the hospital, and the easier attendance on the men. The want of pure and wholesome air cannot be compensated by diet or medicine: hence appears the expediency of carrying, at all times, as many of the sick along with their regiments as can easily be transported.

It may be proper to make the following distinction. In the first part of a campaign, when inflammatory distempers prevail, those who are taken ill are to be left behind; as such cases least admit of motion, and at the same time are not infectious. But those who fall ill from the end of summer to the decline of autumn, as having diseases of a putrid kind, but which bear motion, and generally mend upon a change of air, are rather to be carried with their regiments

* Part i. chap. vii.

(53) Churches, in common with barns, owe their advantages for military hospitals to the height of their cielings. The latter are cooler than churches, from having no windows in them, and currents of air are conveyed through them more directly and more easily to the bunks of the sick.

and dispersed, than collected into one place, to breed and propagate the infection. (54)

As these regimental hospitals are of such consequence, it would be proper to supply them with blankets and medicines from the public stores, with an allowance also for nurses and other necessaries. Nor is this care requisite in the field only, but also in winter-quarters; as there will generally be more sick, on the camp breaking up, than can be well attended by the physicians upon the establishment. In the campaign 1743, about 3000 were left in the general hospitals; and in the year 1747, upon going into winter-quarters, the returns of the sick amounted to 4000. In the course of the former war one physician has had the charge of 700 at a time; in which case, though the hospital might be said to have a physician, it could reap little advantage from his attendance. But suppose that a sufficient number of physicians were employed, yet the crowds, by corrupting the air, would render most of their care ineffectual. This may easily be conceived from what has really happened; for passing over the pestilential mortality in the hospitals of the first campaign, and taking the rest since at a medium, there has been commonly such a degree of bad air in them, as to render the practice but little successful; insomuch, that upon the most favourable computation, I have found that 1 in 10 died of all that were admitted. Besides the better chance for good air, there is a further advantage attending the

(54) This remark should be qualified. It is true, soldiers ill with the hospital-fever are generally benefitted by being gently removed in wagons in *warm* weather, but great mortality uniformly followed the removal of such patients in *cool* or *cold* weather in the same vehicles, in the revolutionary army of the United States.

regimental infirmaries, which is, that the several surgeons are best acquainted with the constitution and disposition of their patients, as well as with all the circumstances of their distempers. And as the physician is still to be resorted to in any case of difficulty, or is to make regular visits, there can be no objection made to this method of treating the sick; which, as often as it has been tried, I have observed to have been more successful than that in the large and general hospitals. To enable the surgeons the better to do their duty to their own regiments, it will be necessary, in time of war, to give each an additional mate; as it must often happen, that the sick will be too numerous to be properly attended by themselves and one mate only: besides, in sickly times, one of them may fall ill, or possibly both.

We shall next consider the general hospitals, which are of two kinds, *viz.* the flying hospital, attending the camp at some convenient distance, and the stationary hospital, which is fixed to a place. In the choice of both, those who have the direction should take care to provide large and airy wards, remembering that warmth is not wanting in summer, and that in winter it is chiefly to be procured by fires. It would also be proper to have those places in towns rather than in villages, as in the former we are likely to find larger rooms, besides other conveniencies.

As to the disposition of hospitals, with regard to preserving the purity of the air, the best rule is, to admit so few patients into each ward, that any one unacquainted with the danger of bad air, might imagine there was room to take in double or triple the number.(55) It will also be found a good expedient, when

(55) This is an excellent rule, and should be carefully attended to by physicians who have the charge of military hospitals.

the cielings are low, to remove some part of them, and to open the garret-story to the tiles. It is surprising in how few days the air will be corrupted in close and crowded wards; and what makes it hard to remedy the evil, is the difficulty of convincing either the nurses, or the sick themselves, of the necessity of opening the doors or windows at any time for air. I have generally found those rooms the most healthful, where, by broken windows and other wants of repair, the air could not be excluded.

It is therefore probable, that when fire-places are wanting, a preservative would be found in the use of the ventilators of my worthy friend Dr. Hales, whereof some might be made for the hospitals small enough to be easily carried about. By such an invention we might hope for a considerable purification of the air in every ward; and the working them might be a good exercise for the convalescents. As these ventilators must be of a smaller size, for the convenience of carriage, the same might be likewise used on board the transport ships.*

The neglect of it deprived the United States of several thousand soldiers during the revolutionary war.

* I was favoured with the following paper of directions from the celebrated inventor, whom I consulted on this occasion, but his method was never put in practice.

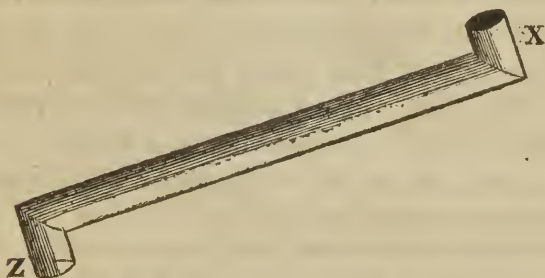
“Some considerations about means to draw the foul air out of the sick-rooms of occasional army-hospitals, in private houses in towns.

“As it seems improper to draw the air out of these rooms, by small moveable ventilators placed in the passages between the rooms, because the foul air that is drawn out will soon return from those passages into the sick rooms; so the most likely means that occur to me for doing it, is to have a board screwed fast, and not nailed, because of the noise, to the upper part of a window on the outside of each room. This board is to have a round hole in it, and also the glass opposite to it, of a

In winter-hospitals, chimneys only should be used, and stoves never; for though the latter may warm a large ward better and at less expense, yet by scarce making any draught of air, they will be apt to promote its corruption; whereas a fire in a chimney acts like a constant ventilator.(56)

“ size to receive a trunk of a sufficient length to reach from the
 “ window to a small ventilator on the ground through which the
 “ foul air is to be drawn out of each room, the fresh air entering
 “ in at the door: this is to be repeated as often in a day as shall
 “ be thought proper.

“ It will be requisite to have the holes both in the board fixed
 “ over the windows, and in the side of the ventilator, made round,
 “ to receive the corresponding round orifices of the trunk; by
 “ which means the same trunk may serve for windows of differ-
 “ ent heights, by being placed more or less obliquely, thus: *viz.*
 “ x, the end at the window; z, the end fixed to the ventilator.



“ There may be trunks of different lengths, and made to join
 “ into each other, for the higher windows. As these trunks are
 “ to be made of thin fir-boards, about five inches broad, they
 “ need not be nailed together in the form of a trunk till they
 “ are to be used, and may therefore lie in a small compass.

“ A very small ventilator will be sufficient for this purpose;
 “ about five feet long, and twenty inches wide and deep, such as
 “ described in my ventilator-book, fig. 6.”

(56) A strict regard ought to be had to this direction. Dr. Tilton combined warmth and ventilation very happily in the log

If ventilators are used, other precautions will be the less necessary; but if they are not, we must have recourse to such other means as may help to purify the air. Among these, the most common is burning of frankincense, the wood or berries of juniper, or some other resinous or antiseptic vegetable. The steams of vinegar have been recommended on these occasions, and probably would best answer the purpose; but being not so commodiously diffused as other things that burn, they have hitherto been less tried. The burning of sulphur, or gunpowder, is also mentioned by authors as proper in such cases; and from the acidity of their steams they seem likely to succeed.

SECTION IV.

How to prevent Diseases arising from improper Diet.

WE are to observe, that no orders will be able to restrain soldiers from eating and drinking what they like, if they have money to purchase it. Therefore a fundamental rule, and indeed almost the only needful, is to oblige the men to eat in messes; by which means, we may be assured the best part of their pay will be bestowed on wholesome food, in as much as what is agreeable to the majority has the best chance for an-

military hospitals, constructed by him in Morris county, New Jersey, by making the fires in a hollow, in the centre of the hospitals, and leaving an opening in the roof in a perpendicular direction to them, through which the smoke was discharged. The bunks surrounded the fireplace. After kindling the fire, the patients suffered no inconvenience from the smoke. Their short and transient sufferings from this cause, were overbalanced by its salutary effects, for it has been proved by Dr. Clark in his treatise upon the diseases incident to long sea-voyages that smoke, checks the propagation of fever from morbid exhalations.

swering that character. And it will be sufficient to leave the choice to their taste and experience, without searching too scrupulously into the nature of particular aliments, which even with more delicate people seldom offend so much in kind as in quantity. The greatest impediments to messing are the wives and children, who must often be maintained on the pay of the men: in such circumstances, it is not improper food, but the want of it that may endanger a soldier's health. This method being established, it only remains to take care that the men be supplied with good bread; and that the markets be so regulated that the traders have encouragement to come to the camp, and the messes have good provisions at a moderate price, vegetables in particular, which during the hot weather ought to make the greatest part of their diet. Though the pay of a British soldier is better than that of other troops abroad, yet his economy is less; so that after giving in his proportion to the mess, there is little danger of his having wherewithal to make a debauch. How far some quantity of strong liquors is useful, has been already shown.*

As the heats of summer tend to produce diseases in autumn, by disposing the humours to corruption, it were to be wished that during the hot season, the diet were so ordered that this tendency might in some measure be corrected. It may deserve our notice, that the Romans considered vinegar as one of the most necessary provisions of an army.† Now, whether this was only used by way of seasoning to their victuals, or mixed with water, and drunk whilst they were hot

* Part ii. chap. ii. § 4.

† Hyeme lignorum et pabuli, æstate aquarum vitanda est difficultas. Frumenti vero, vini, aceti, nec non etiam salis omni tempore vitanda necessitas. *Veget. de Re Milit. lib. iii. cap. iii.*

or feverish, it must have had a good effect in correcting the too great putrescency of the blood during the summer. Vinegar-whey, already known in the hospital, is a cooling medicine in inflammatory fevers, and was liked by the patients. But the surest way of making soldiers take vinegar, or any other acid by way of preservative, is by mixing it with such a proportion of spirits as may be thought a proper quantity for each man; and especially when troops are sent into Zealand, or the more marshy parts of Brabant or Flanders, during the sickly season in those countries.

Pork has sometimes been forbidden in camps, being considered as unwholesome. Sanctorius observes that it checks perspiration; and as it corrupts sooner than beef or mutton, it may be presumed to afford a less proper nourishment than either, when there is danger from putrefaction. It is also believed, that in camps the meat in general is too little bled, and thereby becoming sooner tainted, cooperates with the other causes in breeding putrid diseases.(57)

In establishing the messes some regulations might be made with regard to an allowance of spirits, whether by stoppages on the pay or otherwise. This is already practised in the navy, and probably for the same reason for which it might sometimes be proper here; since, in ships, men are also liable to distempers arising from moist and corrupted air.

The officers, whether in camp, or in cantonments, in a moist country, are exposed, though in a less degree than the common men, to the same diseases of the season and climate. Their chief rule in diet, in sickly times, is to eat moderately avoiding surfeits

(57) This remark applies chiefly to fresh pork. *Salted* pork was found to be a preservative of the health of the revolutionary army of the United States.

and indigestion.* Wine is necessary; but excess in every thing is at this time dangerous. I shall conclude with that prudent rule of Celsus for preserving men against distempers arising from a moist and corrupted state of the air: *Tum vitare oportet fatigationem, cruditatem, frigus, calorem, libidinem.*†

SECTION V.

How to prevent Diseases arising from Errors in Exercise.

THE greatest fatigue which a soldier undergoes, is in making long marches, especially in hot or rainy weather. When the service requires it, such hardships must be endured; but they will be attended with less sickness, if care be taken to supply good provisions and plenty of dry straw. At other times, when despatch is not necessary, short marches before the heat of the day, with proper halts, are so far from harassing the troops, that nothing can be more conducive to the preservation of their health. In fixed camps, as there is always more sickness from inactivity than from fatigue, it would not be amiss to make proper regulations about the exercise at such times; and the rather, as our soldiers left to themselves are naturally too indolent to use what is fit for them.

The exercise of a soldier may be considered under three heads; the first relates to his duty; the second, to his living more commodiously; and the third, to his diversions.

The first, consisting chiefly in the exercise of his arms, will be no less the means of preserving his health

* Si qua intemperantia subest, tutior est in potione quam in esca. Celsus *de Med. lib. i. cap. ii.*

† Lib. i. cap. x.

than of making him expert in his duty;* and frequent returns of this, early and before the sun grows hot, will be more advantageous than repeating it seldom, and staying too long out at a time: for a camp affording little convenience for refreshment, all unnecessary fatigue is to be avoided.

As to the second article, cutting boughs for shading their tents, making trenches around them for carrying off the water, airing the straw, cleaning their clothes and accoutrements, and assisting in the business of the mess, are all things which, as they must be strictly executed by orders, ought to be no disagreeable exercise to the men for some part of the day.

Lastly, as to diversions, since nothing of that sort can be enforced by orders, the men must be encouraged to them, either by the example of their officers, or by small premiums to those who shall excel in any kind of sports, which shall be judged most proper for answering this purpose. But herein some caution is necessary with regard to excess; because our common people generally observe no medium between their love of ease, and pursuing the most violent exercise. And however necessary motion may be to troops in fixed camps, we are to beware, on the other hand, of giving them too much fatigue, especially in hot weather, and in times of sickness; and above all, of exposing them to wet clothes, which, as has been fully set forth, is one of the most frequent causes of camp-diseases.

* *Rei militaris periti, plus quotidiana armorum exercitia ad sanitatem militum putaverunt prodesse, quam medicos—ex quo intelligitur quanto studiosius armorum artem docendus sit semper exercitus, cum ei laboris consuetudo et in castris sanitatem, et in conflictu possit præstare victoriam. VEGET. de Re Milit. lib. iii. cap. ii.*

CHAPTER IV.

The Seasons compared, with regard to the Health of an Army.

IN the beginning of every campaign we are to expect for the first month at least, that the returns will be considerably higher than if the men had remained in quarters. The earliest encampment began on the 8th of April,* and produced such a number of sick, that in a month's time the returns amounted to $\frac{1}{37}$ th part of the whole. In the year 1745, the campaign was opened on the 25th of April; and in 1747, on the 23d of the same month; both in the Low-Countries: but in the year 1746, the troops encamped on the 23d of April, in the north of Scotland, which considering the latitude, may be reckoned of all, the earliest campaign during the war. And from all these instances there is reason to believe, that the first proportion mentioned will generally hold, when the army takes the field in Flanders, in the first or second week of April.

But if the troops are to continue in quarters till the middle of May, the sickness of the first month will be considerably less, though perhaps not so much as might be expected. Thus, in the first campaign, the British encamping on the 17th of May,† had in the hospital, after the first month, about $\frac{1}{32}$ part of the whole number; a proportion, however, which we cannot offer as a general one, because the men had then made a long march, and it was their first campaign. The next year, when the troops marched out on the 13th of May, af-

* Part i. chap. viii.

† Part i. chap. iii.

ter a month's encampment, there was found in the hospitals about $\frac{1}{36}$ th part only; but as the weather was then mild, and other circumstances favourable, the proportion may perhaps be reduced in common years to $\frac{1}{36}$ th: so that, *cæteris paribus*, the number of the sick will be after the first month about $\frac{1}{2}$ th greater when the army encamps in the middle of April, than when it takes the field a month later.

After the first fortnight or three weeks of the encampment, the sickness daily decreases; as the most infirm are already in the hospital, the rest more hardened, and as the weather is growing daily warmer. This healthy state continues throughout the summer,* unless by some extraordinary exposition to rain, the men get wet clothes, or lie wet; in which case, in proportion to the preceding heats, the dysentery will be more or less frequent.

The great sickness commonly begins about the middle or end of August, whilst the days are still hot, but the nights cool and damp, with fogs and dews; then, if not sooner, the dysentery prevails, and though its violence abates by the beginning of October, yet the remitting fever gaining ground, continues throughout the rest of the campaign, and never entirely ceases, even in quarters, till the frosts begin.

The sickness in the beginning of the campaign is so uniform, that the number may be nearly predicted; but for the rest of the season, as the diseases are then of a contagious nature, and depend so much upon the heats of the summer, we cannot foresee how many may fall sick from the beginning to the end of autumn. At the end of the campaign in Germany, the number in the hospitals was to the men in health as 3 to 13.

* That is, until the middle of August.

In 1747, when the troops left the field, the sick made about $\frac{1}{3}$ th part of the whole number: but if we consider by itself the detachment sent that year into Zealand, this proportion was just inverted; for the men in health were to the diseased, only as 1 to 4. Upon closing the campaign in 1744, though half of the army were new men, we had but one in 17 sick; and in the year following, which was remarkable for health, there was not above 1 in 26 ill: but in both these years the troops returned into winter-quarters sooner than usual.

I have observed, that the last fortnight of a campaign, if continued till the beginning of November, is attended with more sickness than the first two months of the encampment. If campaigns are therefore to last six months, it imports much as to health, whether they begin early, or late. For though it may be thought safer for troops to delay encamping till the beginning of May, and stay out till the end of October, yet experience shows it is better to go out a fortnight sooner, in order to return so much the earlier into winter-quarters. (58)

We have already observed, that the remitting fever does not always terminate with the campaign, but continues in quarters till the frosts begin; and that there are no other acute distempers, excepting such as are occasioned by great colds,* from that period till the next encampment. But of chronic diseases, since the autumn has laid so large a foundation for them, a variety will always occur, and those generally arising from obstructed *viscera*. Yet upon the whole, the re-

(58) This is good advice. Autumn is usually an unfriendly season to the health of man in middle latitudes.

* Part ii. chap. i. and ii.

turns of the sick will so much decrease, that if the troops are but tolerably accommodated, and the foregoing autumn has not been unusually bad, they will probably next spring take the field without leaving above one man in 40 behind.

Winter expeditions, though severe in appearance, are attended with little sickness, if the men have good shoes, quarters, fuel and provisions. Of this, we had one proof in the march into Germany; and another, in that to the North in the year of the rebellion. (59) But long marches in summer are not without danger, unless they are made in the night, or so early in the morning as to be finished before the heat of the day.

Those who fall ill in the camp (especially in the decline of summer) so as to be confined for some time to the hospital, are during that season not to be relied upon for service; for being weakened by their sickness and lying warm while under cure, they will be liable to relapse as soon as they return to the field. It would therefore be proper to employ the convalescents in garrisons for the remainder of the campaign, or at least till they have full time to recover; for which end hospitals have neither accommodation nor air. It would also tend much to prevent diseases, if the sickly, or unseasoned corps, were sent a fortnight earlier than

(59) The American revolutionary war furnished a memorable instance of the truth of this remark. Of nearly 2000 Philadelphia militia troops, whom general Cadwallader commanded on the Delaware in the winter of 1776 and 7, and to whom the editor acted as physician general, there was but one death, and not more than half a dozen sick in the course of six weeks, notwithstanding the greatest part of them slept in tents, or in the open air before fires, or upon barn or kitchen floors, during the whole of that time.

the rest into winter-quarters, whenever that is consistent with the service.

Having mentioned the seasoning of troops, it may be proper to add the following caution, as a mistake here may be made so easily. By well seasoned troops are commonly understood, such as having gone through much fatigue are therefore supposed best qualified to bear more. But in this we may be deceived; because such corps as have been rendered sickly by service, will never afterwards be strong, or fit for new labour, till all the infirm are dead or dismissed. For as soldiers in time of war are not only subject to violent disorders, but have little time or convenience for recovery, if once they fall ill it is odds but their constitution will be so weakened, as to make them ever after more liable to sickness. I shall mention two instances. In the year before the war, our troops having encamped on Lexden-heath near Colchester, and staid out late, returned sickly into quarters. Now, it was observable, that those who recovered and went to Flanders were the first sick in the garrisons; and that the same men, with others who were taken ill in the Low-Countries, were also most ailing in the cantonments, and afterwards in the camps in Germany. So that these corps were never healthy till they lost all their weak men; which indeed in a great measure happened during the course of the first campaign. The second instance is of those detachments in Zealand, and at Bergen-op-Zoom, which suffering greatly by the bad air of the country, the same battalions, in the beginning of the next campaign, were remarkably more sickly than any of the rest.* But as the first campaign in Flanders (though succeeding the sickly

* Part i. chap. vii and viii.

one in Germany) was healthful,† and the next was still more so,‡ some may thence infer, that troops are only liable to suffer in the first year, and being then seasoned will afterwards undergo the usual military fatigues unhurt. But besides that the weather was most favourable during the second and third campaigns, and that the camp broke up early in both, it must be remembered, that all the corps which had been in Germany had lost almost all their sickly men there; so that those who took the field, in the next year, were either old soldiers, who had never been ill, or recruits, additional, or regiments which had come fresh from England: these therefore holding out well, were rather a proof of what is advanced above. And if the third campaign was still more healthful than the second, it is to be observed, that the army happened then to be in its best state; consisting chiefly of fresh soldiers, or of men who never had been ill, or of those who were properly seasoned, by having made a short campaign in moderate weather. As a further proof that the health and hardiness of troops is not to be measured by the time they have served, in the two last years of the war, the sick were in proportion as numerous as they had been in the two first; and what happened in the cantonments in Dutch Brabant, during the last campaign, shows that no seasoning can avail against the influence of the moist and corrupted air of marshes. (60)

† Part i. chap. iv.

‡ Chap. v.

(60) There is no contradiction in this remark to one made by our author in the thirtieth page. Habit, so universal in its effects in protecting soldiers from the common diseases incident to the military life, exerts no influence over the system in defending it from autumnal fevers in climates alternately hot and cold. The

The whole amounts to this. Considering all the hardships, and expositions to cold attending the easiest service, those troops will be best seasoned to undergo the fatigues of a second campaign, whose constitution has been least weakened in the first.

same remark applies to all other classes of people inhabiting similar climates.

OBSERVATIONS
ON THE
DISEASES OF THE ARMY.

PART III.

CHAPTER I.

Observations on Colds, and Inflammatory Fevers in general.

HAVING laid down the division of the diseases most incident to an army, with the remoter causes and means of prevention, I shall proceed in this part to offer some practical observations upon each distemper, in the order in which they were proposed;* and therefore shall begin with such as depend upon inflammation only.

But as inflammatory disorders are every where common, and are treated of by so many authors, I shall not enter into a particular account of any, but make a few remarks on such as most frequently occur in military hospitals.

Upon first taking the field, as well as during the winter, pleurisies and peripneumonies are the most common forms of the inflammatory fever; and next to them, fevers attended with rheumatic pains. The

* Part ii. chap. i.

inflammation turns also upon the brain, liver, stomach, and other *viscera*. Universally, the fever taking its rise from a stoppage of perspiration (or from whatever is the primary effect of cold) by first inflaming any of these parts seems afterwards to be kept up by that inflammation.

Sometimes we can perceive no part more affected than another, and only some general inflammatory symptoms. The distemper is then called simply an inflammatory fever, although probably some of the more indolent parts may at this time be affected with inflammation. This fever is most common after the weather begins to be warm. But inflammatory fevers are seldom seen single in the end of summer, or in autumn; for at such times expositions to cold, or moisture, produce fevers and fluxes of a putrid kind, where the inflammation seems to be often the least part of the disease.

For after the summer solstice, the fevers tend mostly to remit, and are attended with less sizzly and more putrescent blood. But towards the end of the campaign, when the weather grows cold, more inflammatory symptoms are joined; so that the fevers may be said, at that time, to depend on two different causes.

Among the mixed inflammatory fevers may be likewise reckoned the vernal intermittents, which upon the first encampment not only seize those who have had agues in the preceding autumn, but others who never had any. These are the more carefully to be distinguished from true intermittents, as they are to be treated chiefly by bleeding and other antiphlogistic remedies. When the bark has been given whilst the blood was inflamed, or before there was a proper intermission, I have observed that the distemper

would either change into a continued fever, or stop for a while to recur with worse symptoms.

The inflammatory fevers of an army differ from others, only in being more violent, and perhaps more frequently attended with a *diarrhœa*. The severities of the weather, to which a soldier is so much exposed, his backwardness to complain of the first symptoms, his rough lying when first taken ill, or his being carried to an hospital at a distance in a wagon, when already in a fever, account sufficiently for the first; and it is the stoppage of perspiration by lying cold, or by drinking improper liquors when first seized, that is the cause of the looseness.

As bleeding is the principal remedy in the cure of inflammatory disorders, the delaying it too long, or not repeating it often enough in the beginning of bad colds, is the chief cause of their ending in dangerous inflammatory fevers, in rheumatisms, or consumptions; and as a soldier applies first to the surgeon of his regiment, on him it chiefly depends to prevent many deaths, by the timely use of the lancet. In general, young practitioners are too sparing in letting blood, and delay it too long. But the surgeon may be assured that soldiers will seldom complain of a cough, or pains with inflammatory symptoms, wherein immediate bleeding is not proper; and from the continuance of the complaints, he is to judge of the necessity of repeating the evacuation, which, in the case of a stitch or difficult breathing, is never to be omitted in some quantity, even in the advanced state of the fever. I have generally ordered from twelve to sixteen ounces, to be let at the first or second bleeding, but less at all the rest. Here it may be proper to follow Celsus's rule, in observing the colour and consistence of the blood whilst it flows; that is, when it is thickish and

of a dark cast (which it is in difficult breathing and great inflammations) to take it away more freely.*(61) When large quantities are necessary, it is best to bleed the patient lying, in order to prevent his fainting before enough be drawn: otherwise, in all inflammatory pains, the *animi deliquium*, upon the loss of blood, is reckoned a favourable circumstance.

Another prevention consists in an early sweat; for which one of the best medicines is a draught of vinegar-whey with some spirits of hartshorn, at bed-time†. It has been usual to give the *theriaca* for this purpose; but all such drugs increase the fever if they do not procure a sweat, whereas this saline mixture operates without heating. The *theriaca* is rendered more sudorific by adding to half a drachm some grains of the salt of hartshorn, and by encouraging the sweat with vinegar-whey, or thin water-gruel acidulated with vinegar. But as to preventing fevers, that falls more in the way of the regimental surgeons than of the physician attending the hospital, who rarely sees the patient till either the fever be quite formed, or at least so far advanced as not to be removed by sweating. (62)

If therefore the feverish disorder or cold has been of two or three days' standing, it is to be treated by

* De Med. lib. ii. cap. x.

(61) The editor has borne testimony to the truth of this remark in his defence of bloodletting. He infers the existence of great inflammation, from the colour of the blood, resembling claret, while it is flowing.

† Or give at bed-time two scruples of the salt of hartshorn, saturated with about three spoonfuls of common vinegar, in one draught, and promote the *diaphoresis* with some warm diluting liquor.

(62) It is in the forming state of violent fevers only, that artificial sweats are useful. After they are completely formed, they are generally hurtful when excited by stimulating remedies.

bleeding, and such medicines as are not heating, and yet tend to remove the inflammatory obstruction and promote perspiration. Some have thought nothing so efficacious for this intention as the *spiritus Mindereri*,* the internal use of which was first mentioned by the celebrated Boerhaave, and afterwards introduced into practice, at Edinburgh, by the late Dr. John Clerk, a physician of eminence in that city.† But during the former war I followed the common method of joining the *testacea* to nitre, without any particular attention at first to the effects of the former; but as I have since discovered a septic quality in those substances by experiments out of the body, it seems natural to conclude that they exert a like power when taken by way

* *Pharmacop. Edinburg.* But it is to be observed, that as to the names and compositions of medicines, unless where it is expressed otherwise, as here, I follow the last edition of the London Dispensatory, *viz.* that of the year 1746.

† As it may give satisfaction to the reader, to have Doctor Clerk's observations upon the effects of this medicine in various cases, I shall subjoin his own account, in the following extract of a letter which he favoured me with on this subject.

“ In relation to the *spiritus Mindereri*, I never gave above
 “ half an ounce for a dose. When I intend to promote a *diure-*
 “ *sis*, I give that quantity twice a day, mixed with an equal pro-
 “ portion of *syrupus de althæa*, and find it seldom fail. But in a
 “ dropsy, I more commonly make use of the *julapium diureti-*
 “ *cum Pharmacopœiæ Pauperum Edinburgensis*. I have some-
 “ times added the *sal succini*, when I was sure of its being genu-
 “ ine; but that is rarely to be found. For that reason it is left out
 “ of the *Pharmacopœia Pauperum*, and the spirit put in its place;
 “ which has the same *ratio* to the salt, that the spirit of hartshorn
 “ has to its salt; though formerly not being in use, it was thrown
 “ away as of no value. When I give the *spiritus Mindereri* to
 “ promote a *diaphoresis*, I always add a small quantity of *sal cor-*
 “ *nu cervi* to give it the alkaline cast, as in the *haustus diaphore-*
 “ *ticus Pharmacopœiæ Pauperum*. When I design to bring on a
 “ plentiful sweating, as in rheumatic diseases, I use the *julupi-*

of medicine.* And this perhaps would be more frequently seen, were it not for the quantity of acids usually given in acute diseases; in which case not only the septic nature of the *testacea* may be destroyed, but the acid neutralized, and thereby rendered more diaphoretic. The putrefying quality of these powders is

“*um diaphoreticum* (*Pharmacop. Pauher.*) two spoonfuls every hour, or hour and half, till the sweat breaks out: repeating it *pro re nata*, when warm diluting liquors are not sufficient to keep it up. I have given of the spirit in this manner about two ounces, and ten grains of the *sal cornu cervi* in the space of four and twenty hours. In topical inflammations, I give the acid cast by mixing with it an equal quantity of *acetum scilliticum*. I have often given it so in pleurisies and peripneumonies. I understand that some of my brethren use this form only. Of all neutrals, I take the *sal ammoniacum crudum* to come nearest the *spiritus Mindereri*. I use sometimes the *bolus diaphoreticus Pharmacopœiæ Pauherum*, but I do not find it nearly so efficacious as the julep.” Some doubts arising, since Dr. Clerk’s death, about the dose of his squill-mixture, I consulted his son Dr. David Clerk, one of the physicians to the Royal Infirmary at Edinburgh, who informed me, that he believed there was a mistake in his father’s letter, of *acetum scilliticum* for *syrupus scilliticus*; and that his father did not give the *spiritus Mindereri*-mixture in the same quantity with and without the *syrupus scilliticus*. He added, that he had found in the *liber memorialis* of his father the following receipt: *℞ Aquæ hyssopi (vel cinnamomi sine vino) spiritûs Mindereri syrupi scillitici aa ℥ij. misce. Dentur cochlearia ij. bis die.* That this was his common dose of all his *julapia scillitica*; but when the stomach could not bear so much in the morning, he then gave but one spoonful. That he himself did not particularly remember, how much of this mixture his father gave in the pleurisy and peripneumony, but believed, that the quantity did not exceed four or five spoonfuls in the day. He concluded with remarking, that considering the different manner of making the vinegar of squills at London, and at Edinburgh, the London preparation was likely to be much stronger than the other.

* Append. Paper iii. exp. xxiii.

also corrected by the *contrayerva*-root, and by the camphire which was added to them. The common dose was a scruple of the *pulvis contrayervæ compositus*, with ten grains of nitre, and three grains of camphire reduced to a powder, and given four times a day.

These powders were given partly to promote a *diaphoresis*, when nature seemed to be pointing that way, and partly to abate spasms, as the head was so apt to be affected: upon the whole it was a medicine which had little sensible effect, and therefore I laid the less stress upon it. We may observe, that in fevers in different countries and different ages, besides those remedies which have a manifest action, physicians have used others, which though operating imperceptibly have yet been imagined to be of some efficacy towards conquering the disease. But as their practice was founded on the theory then prevailing, when that changed, so did the medicine; and this will probably be the case till the nature of a fever be better understood.

My first practice in every inflammatory fever was to blister, and especially in the advanced state when I believed that the patient could not bear any farther loss of blood. But afterwards, when I found that a solution of the fever was not to be procured by such means, I confined the use of blisters to those states of the disease in which I could be the most assured of their efficacy. Such was that of a headach, when not removed by the first bleeding and by opening the body; in this case a blister between the shoulders seldom failed of giving ease.

To the same place, though not with equal certainty of relief, a blister was applied, when the patient had a cough (which he generally had) or any other sign of inflammation in the lungs: but when he complained

of a stitch in his side, the plaster was laid on the part affected. In these circumstances I likewise ordered some pectoral drink, and an oily mixture which shall be mentioned when I come to the pleurisy. In a *delirium*, I followed that course which shall be laid down in the next chapter.

If the body was bound, I opened it (after the first bleeding) with some lenient physic; but throughout the course of the fever I found it sufficient to prevent costiveness by daily clysters,* if the patient had not otherwise regular stools. After recovery, some mild purge was often requisite, in order to prevent the too hasty repletion of the convalescents, upon indulging their appetite: cathartics at that time seemed otherwise unnecessary. But if the fever in the beginning was attended with gripes and a looseness, after bleeding I gave some rhubarb; and if the purging still continued, I endeavoured to check it by the chalk-julep only; and afterwards proceeded in the method as above.

Towards the *crisis*, or in the decline of the fever, a little wine was added to the panada, or given in some other shape, as the best cordial; and in great sinkings, I preferred some drops of spirit of hartshorn, in a teacupful of white wine whey, to every other medicine of that intention.

After showing that so much depends on early and repeated bleedings in the beginning of these fevers, and on blisters, I can offer no remark more useful than what relates to opiates, which otherwise one might be too apt to have recourse to, amidst so many complaints of pain, looseness, and want of rest. With

* A motion or two daily, procured in this way, I have observed to be one of the best and most general remedies in fevers.

regard to the two first, I have already proposed what I found sufficient for the cure; but as to the watchfulness, I shall observe, that opiates ought only to be used in the advanced state of the disease, when the inflammatory symptoms are much abated, when the head is not affected, and when the patient after long watching believes he should be well enough if he could but sleep. At such times, and especially at the crisis, and after it, I have usually given two scruples of the *confectio Damocratis* at bed-time, and with good effects. If the paregoric be continued, costiveness must be prevented by clysters or some mild laxative.

In these, as in other fevers, thirst was moderated by acidulating the barley water with vinegar, or by balm tea with lemon juice. And as to diet, the patient was always kept upon the lowest, such as panada, watergruel, and the like, without allowing any broth till after a breaking and a sediment in the urine: when that happened, a decoction of the bark, or the elixir of vitriol, completed the cure.

CHAPTER II.

Observations on particular Inflammations.

SECTION I.

Of the Inflammation of the Brain.

THE *phrenitis* or inflammation of the brain, considered as an original inflammation, is properly a summer disease, when men are exposed to the ardour of the sun; and especially whilst asleep and in liquor. But a symptomatic *phrenitis* or *delirium* is one of the most general inflammatory symptoms, is confined to no season, and happens indifferently in the bilious, malignant, or inflammatory fever. It is more common in military hospitals than elsewhere, on account of the violence done to all fevers when the sick are carried in wagons from the camp to an hospital, where the very noise, or light alone, would be sufficient with more delicate natures to raise a frenzy. (63)

An original inflammation of the brain, requires immediate, large and repeated bleedings; and the relief is thought to be the more certain if the blood be

(63) The editor has frequently seen this remark verified. The removal of patients in the first, or violent stage of all fevers, whether in wagons, coaches, or single horse chairs, often induces, not only delirium, but precipitates death. Many of the patients ill with the yellow fever, who were brought to the city hospital on the Schuylkill in the year 1798, died a few hours after they were admitted in it. One instance occurred of a patient being taken out of a chair dead, when he arrived at the door of the hospital. It is to be lamented that a mode of conveying patients to hospitals has not been devised more consistent with the dictates of medical science and christian humanity.

taken from the jugular. I have never advised cutting the temporal artery, finding so much relief from applying three or four leeches to each temple after bleeding in the arm.* The benefit thence arising may be compared to the effects of an hæmorrhage by the nose. The rest of the cure consists in the medicines common to all inflammatory fevers.

The symptomatic *phrenitis* is also treated by opening a vein, if the pulse can bear it; but if this cannot be done by reason of lowness, the cure is to be attempted by leeches and blisters. It is usual in blistering to begin with the head, but in military hospitals I found it convenient to leave that to the last; (64) because barbers are careless, and in cutting the skin expose the patient more to a strangury.† The common internal medicine was the diaphoretic powder mentioned in the last chapter.

A *phrenitis* is often brought on, or increased, in

* I have sometimes applied six to each temple.

(64) Other reasons may be given for not applying blisters to the head in the early stage of phrenitis, besides that given by our author. In the highly excited state of the brain, they are either inactive or hurtful. By applying blisters to the limbs an epispassic disease is created, which abstracts morbid excitement from the brain, if not wholly, yet to such a degree as to render blisters to the head afterwards both safe and useful. Care should be taken not to apply blisters even to the limbs, until the disease in the brain has been loosened, or reduced by means of depleting remedies to such a degree as to be translated to the extremities of the body. The same reasonings apply to the cure of all other violent diseases of the brain.

† Upon reading this passage in the first edition, Dr. Whytt, professor of medicine in the university of Edinburgh, wrote to me, he had observed, that by shaving the head twelve or fifteen hours before the application of the blister, a strangury was generally prevented. Sometimes I have found the brain sensibly relieved by cutting off the hair and shaving the head, though no

the hospitals of an army, by the want of due perspiration, and of warmth in the extremities. Therefore, as soon as a soldier is brought into the house with feverish symptoms, his hands and feet should be washed with warm vinegar and water. And I would likewise recommend for the hospitals, what I have sometimes since in a *phrenitis* successfully used in my private practice, a fomentation to the feet and lower part of the legs with double flannels wrung out of water (with a seventh of vinegar) made agreeably warm, and repeated often for an hour or two at a time.(66)

SECTION II.

Of the Inflammation of the Eyes.

SOLDIERS are subject to an *ophthalmia* or inflammation of the eyes, not only from winter colds, but from their frequent exposition to the sun and dust during the campaign. The slighter cases may be cured without bleeding; but if any degree of fever be joined, or the inflammation be considerable, this evacuation

plaster was applied; (65) and since the first edition, I have in such cases, out of the hospital, given the *sal sedativum* of Homberg, to the quantity of 25 grains every four hours, and, as I have imagined, with good effect; but as I never trusted to that medicine singly, I cannot speak of it with certainty.

(65) This practice recommended by Dr. Whytt has been found to be extremely useful, not only in the acute diseases of the head, but in many of its chronic diseases. Headach has often been cured by it. The connexion of the hair with diseases is evident from its burning crisp, losing its curls, and even becoming erect, in their forming state.

(66) These fomentations, like blisters to the limbs in *phrenitis*, produce the best effects after the partial reduction of the morbid excitement of the brain by depleting remedies.

ought not to be omitted. The greater inflammations are not to be cured without large bleeding, unless we can make a derivation from the part affected without draining the whole body. For this purpose, blisters are usefully applied behind the ears, especially if they are continued for two or three days, and if the sores are afterwards kept running. This part of the cure is sufficiently known. But what I have observed to be sometimes more efficacious, though less generally practised, is bleeding by leeches; when two or more are applied to the lower part of the orbit, or near the external angle of the eye, and the wounds allowed to ooze till they stop of themselves. Therefore in all greater inflammations, after bleeding in the arm or jugular, I have used this method, and repeated it more than once if required. The practice is no less proper in an inflammation of the eyes from a hurt or blow: only in great fluxions, some blood is to be first taken from the arm, and immediately after, a revulsion is to be made by a brisk purge. But though these means are proper in the common *ophthlamia*, they are not to be relied on when the disease arises from a scrofulous, or a venereal cause.*

In all cases, we are to look often and narrowly into the inflamed eyes; since the inflammation may either be occasioned, or kept up by moats, or by hairs

* There are also inflammations and ulcers of the eye-lids, which are often mistaken for disorders of the eye itself, but are not to be cured by the common ophthalmic medicines. The following liniment, communicated to me by a friend who had given particular attention to this branch of medicine, I once found efficacious:

R Unguenti albi ℥v. sacchari Saturni ℥i. quibus super flor-
phyrite simul tritis instillentur balsami traumatici ℥ij.
Hujus paululum, linteo exceptum, oculo dolenti omni nocte im-
ponatur.

of the *cilia* falling in, or growing inwards, so as to cause a constant irritation.

The slighter inflammations from the dust, or the sun, were removed by fomenting with warm milk and water, adding a small proportion of brandy; and by anointing the eyes with the *unguentum tutiæ*, or the like, at night. But in bad cases, after the inflammation had yielded a little to evacuations, I found the *coagulum aluminosum* of the London Dispensatory, spread on lint and applied at bed-time, the best external remedy. Till then the patient is to use a solution of white vitriol: or, in violent pains, to foment frequently with a decoction of white poppy heads.

SECTION III.

Of the Inflammation of the Throat.

THE inflammatory *angina* is most frequent and dangerous upon the first encampment. Its tendency to bring on a suffocation requires speedy and large bleedings, purging and blistering; but the method of using all these being so well laid down by Sydenham, I shall only mention another remedy which I have sometimes found useful. Let a piece of thick flannel, moistened with two parts of common sweet oil and one of spirit of hartshorn (or in such a proportion as the skin will bear) be applied to the throat, and renewed once in four of five hours.* By this means the neck, and sometimes the whole body, is put into a sweat; which, after bleeding, either carries off or lessens the inflammation. The *formula* is new but not the whole intention; for the ancients applied warm oil

* This medicine I had from the late Dr. Young, physician at Edinburgh.

with a sponge, and warm bags with salt;* and some later writers have recommended poultices made of the dung of animals,† which seems to be only a coarse and an offensive way of using the volatiles.

I observed little benefit from common gargles; for at that time I did not think of injecting them with a syringe, which I now constantly do. By this method, the patient brings away a great deal of tough phlegm, and generally finds some immediate relief, from clearing the glands of the *fauces*. My composition is thirteen ounces of barley-water (or sage tea) with two ounces of *mel rosarum* and one ounce of vinegar; sometimes I have added a spoonful of mustard for a greater *stimulus*. The bleedings, the laxatives, the blisters, and this gargle are all the medicines I now find necessary. And even in the *angina maligna* or ulcerous sore throat, I lay the chief stress of the cure upon gargling in this manner. In all cases, I direct five or six syringefuls to be injected, one after another, as far into the throat as the patient can bear, and the medicine to be repeated three times a day.‡

* Cels. lib. iv. cap. iv.

† Etmuller. cap. de angina.

‡ In later practice, besides a blister to the back, in bad cases I have laid one across the throat: at other times I have applied 7 or 8 leeches under the *fauces*; and when the patient has been brought low by the loss of much blood from the arm, I have opened one of the veins under the tongue, and taken away two or three spoonfuls: all these methods at times have had a good effect. But when an abscess is formed, which the lancet cannot reach, its breaking will be hastened by a common vomit.

SECTION IV.

Of the Pleurisy and Inflammation of the Lungs.

THE pleurisy and peripneumony are the most frequent forms of our inflammatory fever. It is to be remembered, that in these disorders the pain may be felt in any part of the chest, behind or before, as well as in the sides; and sometimes so low down, as to be mistaken for an inflammation of some of the abdominal *viscera*, such as the liver, spleen, or kidneys.

Without entering scrupulously into the distinction, which most authors have made, between a pleurisy and peripneumony, I shall mention those remedies, which I used with most success in such pains of the breast, sharp or obtuse, as were attended with difficulty in breathing, almost always with a cough, and never were without some fever. For we are not to confound these inflammatory pains, and difficulties in breathing, with some spasmodic stitches (which seizing the muscles of respiration are not accompanied with a fever, and may be removed by externals only) nor with certain flatulent pains of the side, if I may so call them, to which hypochondriacal and hysterical persons are most subject. Such cases indeed came seldom into our hospitals. But to the same kind of flatulent stitches every person is liable, when brought low by sickness, and especially by any disorder of the bowels. These pains may be owing to wind confined, or to excrements pent up in that part of the *colon* next the diaphragm. They generally strike from the breast to the back, or from side to side, affect the breathing, and are sometimes attended with a short and frequent cough. But the fever and siziness of the blood, with other marks of a true pleurisy are wanting. Bleeding

may do harm, but carminative laxatives, with warm applications to the part, give ease. A blister perhaps is the only remedy common to both.

Although we cannot admit the critical days, yet we must observe with the ancients certain states of those inflammations of the breast, which are attended with different symptoms, and require a different method of cure. The sick are often brought into the hospital when the inflammation has spread upon the lungs, and gone too far to yield to evacuations. Now, however improper it would be at this time to commit the whole to nature, yet if the *sputum* appears, as described by Hippocrates, we are to consider it as the chief remedy, and are not to divert it by bleeding or purging; as I have found upon trial.

With these cautions we are to proceed, letting blood freely for the first three or four days of the disease; but, if in that time the spitting begins, the bleeding must either be wholly omitted, or so moderated as to relieve the breast, without impairing the strength or checking the expectoration.

With regard to the quantity, and repetitions of bleeding, no precise rule can be given. Sydenham has specified forty ounces for the whole quantity which men may, at a medium, lose in a pleurisy; but this, in our circumstances, would have been too little had it not been for blisters, which not only shortened the cure but prevented the loss of a great deal of blood.

A pleurisy, taken in the beginning, will often be cured by one large bleeding, and a blister laid on the side affected. The objection to this practice is founded on the stimulating quality of the *cantharides*; but the relief is so certain, that theory ought only to be employed here in accounting for the resolution of an in-

ternal spasm, or obstruction, by such a stimulus upon the skin.(67)

This method of blistering the side is ancient, and was performed by *sinapisms*;* but now only *cantharides* are used, and the practice is become common in Britain. Some difficulty remains about the time of application, whether it is best to apply the blister in the beginning, or to wait till the pulse be softened by frequent bleeding. The experience which I have had induces me to prefer the former; for in treating great numbers in the hospitals, I found no inconvenience from using the blister immediately after the first bleeding, but, on the contrary, a more sudden and certain relief. Nay frequently, when the surgeon was not at hand, I have had the plaster put directly to the side, and the patient bled afterwards; being satisfied if the vein was opened before the *flies* had time to stimulate. These lateral blisters, as well as those for the back, were made as large as the palm of the hand with the fingers; a size unusual any where but in this country.

Although the symptoms may vanish upon blistering, it will be more secure to bleed again, unless a sweat comes on with a relief from pain, and makes this and other remedies unnecessary. But, if the lungs are much inflamed the cure cannot be speedy; for though the first bleeding and blister should give ease, yet repetitions of both will be needful. Sometimes the stitch returns and fixes in the other side; but this being treated as the first, will also give way.

(67) Experience proves this practice to be successful, nor is it contrary to reason, for the depletion obtained by it, counteracts the less evil of a transient stimulus from the blister. The skin of the side moreover possesses but a feeble sympathy with the blood-vessels of the whole body.

* Cels. lib. iv. cap. vi.

A distinction has commonly been made between the pleurisy and peripneumony, which I likewise followed in the former editions. But having since read the dissections and remarks of those celebrated authors De Haller* and Morgagni† relating to this subject, I am convinced that we ought to consider these two distempers as one, in which the lungs are always inflamed, and often without the pleura; but the pleura never, without the lungs. (68) Wherever the pain is, I apply a large blister to the part; and if there is no particular stitch, but only a general oppression, I lay the plaster between the shoulders; and afterwards, if the disease is obstinate, first to one side and then to the other. Blisters, not only when applied to the chest but also to the extremities, tend to relieve the breast, and to promote expectoration; whereas bleeding must be used cautiously, if at all, after the *sputum* appears.

Not only during the height of the inflammation, but throughout the state of expectoration, I give the patient from hour to hour a small teacupful of a pectoral infusion warm,‡ and once in five or six hours, four spoonfuls of an oily mixture.§ But when the expectoration flags, instead of this last medicine, I order as much of the *oxymel scilliticum* as the patient

* Opuscul. Pathol. obs. xiii. xiv.

† De Sed. & Caus. Morb. ep. xx. et xxi.

(68) Dissections confirm this remark. The editor has followed the author's practice with advantage, in applying blisters *first* between the shoulders in general affections of the lungs without local pain.

‡ *Viz.* An infusion made of the ingredients of the *decoctum pectorale*; to a quart of which, add an ounce of the simple *Oxymel*.

§ *R Mellis (vel syrapi ex althæa) ℥vi. gummi Arabici in pulverem contriti ℥i. aquæ rosarum ℥ii. accurate subactis admisce invicem olei amygdalarum dulcium ℥iss. et aquæ puræ ℥vi.*

can take without sickness, or purging. Or, what I have often found more effectual, four spoonfuls once in six or eight hours of a solution of gum *Ammoniacum*.* I have likewise observed good effects from making the patient breathe over the steam of hot water: a practice recommended by Boerhaave and the Baron van Swieten, and confirmed to me by the repeated trials of Dr. Huck, who found it more beneficial when the phlegm was viscid, as well as more grateful to the patient, by adding a small portion of vinegar. (69) This is my present practice. In the hospital, when the patient was reduced by repeated bleedings, I found the *sal cornu cervi* joined to *sperma ceti* not only proper for raising the pulse but for promoting expectoration.†

If notwithstanding this discharge, the patient complains much of a stitch, or labour in breathing, it is still necessary to bleed. But in this case there is danger of falling into one of these extremes; either of suffering the lungs to be overpowered, by omitting to bleed; or of hazarding the suppression of the *sputum*, by bleeding too freely. Trillerus, Huxham, and the Baron van Swieten have delivered the rules how to proceed here. But, with regard to blisters, there need be no caution at such a juncture, as they

* R *Spermatiss ceti (ex vitello ovi quantum satis est soluti)* ℥ij. *lactis Ammoniaci* ℥vii. *syrupi croci* ℥vi. *misce.*

(69) Too much cannot be said in favour of this simple and powerful remedy. The editor has seen patients snatched from the jaws of death by it. Where a prompt effect is wished for, water should be poured upon a heated shovel. The vapour in this case is poured in a stream into the lungs.

† This is the formula which I have generally used:

R *Spermatiss ceti (ex vitello ovi soluti)* ℥iii. *aque putræ* ℥vii. *salis cornu cervi* ℥i. *syrupi balsamici* ℥i. *misce.*

are always seasonable, whether for raising the pulse or relieving the breast.

In the course of expectoration, a vomit has sometimes contributed to discharge the viscid phlegm.(70) Sometimes opiates may be given, but with caution; for, as long as the pulse is hard, or the breathing difficult, or when watchfulness is owing to the fever, they do harm. But when the fever has ceased, and sleep is only prevented by a thin rheum falling on the *fauces*, or lungs, opiates, and especially if joined to squills, will both give rest and promote expectoration.

SECTION V.

Of the Inflammation of the Liver.

THE liver is a part not only liable to original inflammations, but also to suffer by translations of matter. I have found by several dissections that this *viscus*, next to the lungs, is most subject to suppuration; but I have known one case only cured after an abscess. In this, the matter pointing was let out, and the patient soon after recovered.

Another case occurred, remarkable for the situation of the abscess, which was entirely on the left side of the *linea alba*. The incision was nevertheless made, and a large quantity of *pus* was evacuated. The patient was relieved, but the operation having been delayed perhaps too long, he died soon after. Upon opening the body, the incision was found to have passed into the liver, but to have been too small for discharging all the matter.

A third case was singular for the flatness of the

(70) The editor can subscribe to the benefits of this practice, and he believes with Dr. Huxham, that patients when very weak in acute diseases, bear depletion by puking, much better than by bleeding, purging, or sweating.

tumour, and an unusual difficulty in breathing; for the man could not lie extended, but for the most part rested in a prone posture upon his knees and hands. He had frequent retchings to vomit, with a constant and uncommon pain at his stomach and sickness; and two days before his death he grew yellow, and was seized with a hiccup. The body being opened, the liver was found wholly scirrhus, or purulent. The thick and posterior lobe was suppurated; and another large abscess rose from the concave part, which thrust the stomach outwards in such a manner, that had an incision been made before death, as in the former case, it must have passed through the stomach before it came to the bag.

As to the cure of an inflammation of the liver, I have made no remark that deserves notice; unless that with plentiful bleeding, one of the best remedies is a large blister laid over the part affected.

SECTION VI.

Of the Inflammation of the Stomach and Intestines.

THE same method has been practised in the inflammation of the stomach and intestines; nor have I known these local blisters attended with any bad consequences, though applied early in the disease. In particular, they were useful in the *ileus* or inflammatory colic; and often answered in fixed pains of the bowels from spasms, without evident marks of inflammation.

To this observation relating to the effects of blisters in pains of the *abdomen*, I shall subjoin a few remarks upon the inflammation of the bowels, which have occurred upon further reflection, and more experience.

The *εἰλεὸς*, *ileus* (improperly rendered *volvulus*) ac-

according to Galen, “is an inflammation of the intestines attended with violent gripes, and such a constriction as to allow no passage for either the *fæces* or flatulence.”* This definition, where vomiting is not named, is nevertheless agreeable to the description of the *ileus* by Hippocrates,† who mentions both a bilious and a stercoraceous vomiting, but which he considers as additional symptoms when the distemper rises to a height. For in the Aphorisms,‡ Hippocrates observes, that “in the *ileus*, vomiting is a bad sign;” which seems to imply, that there may be an *ileus* without any vomiting at all. And Aretæus,§ who of all the ancients has given us the fullest and most satisfactory account of the disease, takes notice of three degrees of it; one, in which the stomach is oppressed, without vomiting; another, in which the patient brings up phlegm and gall; and the third and fatal one, when he voids his excrements by the mouth. From this it appears, that whenever there are acute pains of the bowels, attended with an oppression at the stomach, great costiveness, and (if I may add from Hippocrates) a tension of the belly, of all perhaps the most constant symptom, without regarding whether there is vomiting or not, we may freely determine the case to be the *ileus* of the ancients; and from them draw what lights they can furnish with regard to the cure. But if, in conformity with some of the best of the moderns, we should only call that an *iliac passion*, in which the peristaltic motion is wholly inverted, our practice can receive no assistance from the Greeks, who supposed that state of the *ileus* to be incurable.

Thus Sydenham, when to the above symptoms even a vomiting of the food is joined, allows no other

* Lib. de Definit.

† De Morb. lib. iii.

‡ Sect. vii. aph. x.

§ Acut. Morb. lib. ii. cap. vi.

name to the disorder than that of the *passio iliaca notha*,* as supposing in that case only a partial inversion of the peristaltic motion; and he considers the rendering of clysters by the mouth as the mark of a total inversion, and therefore a pathognomonic symptom of the true iliac passion: *quando liquet ex clysteribus per os ejectis et aliis signis verum esse ileum, &c.* † This *ileus verus* of Sydenham I never saw but once (the patient died) and I should imagine, that it has been but rarely seen in our times by those in the greatest practice, and seldom or never cured:(71) so that it may seem extraordinary, that in his days it should occur so often, as to satisfy him about the certainty of his method of cure; and the more, as the remedies which he used would now appear inadequate to much milder degrees of the disease. But that excellent author appears to have been afterwards sensible of the insufficiency of his former practice; for in the *Processus Integri* (his posthumous work) he omits part of it, and adds some more powerful remedies, which still perhaps, in other hands, would prove ineffectual.

As to all the lesser degrees of the *ileus*, we must look in Sydenham for their description and cure, under the title of *colica biliosa*; which we may be the more certain is the same distemper with the *ileus*, as the author himself says, that if this colic was not timely remedied, it terminated in the *iliac passion*. ‡(72) But it is to be wished that Sydenham had not given the name of *bilious colic* to the *ileus*, nor considered it in the light he has done; because upon his authority

* Sect. i. cap. vi.

† Ibid.

(71) The editor has seen one recovery, he does not say cure, after this symptom had taken place.

‡ Sect. iv. cap. vii.

(72) There would be the same propriety in giving as many

many have been led to correct, and to evacuate the bile (perhaps faultless) without sufficiently attending to the inflammation, as he does not mention it. Sydenham bleeds but once; from which circumstance alone we may judge, that he had never inquired how the bowels of those who died of the distemper appeared after death, nor apprehended any danger from a mortification, which from numerous dissections we are now assured is always threatened.

Having had these reasons to diviate from Sydenham's practice, I followed the more ancient one, of bleeding largely and often, as long as the violence of the symptoms remained, or whilst the strength permitted. If after the first bleeding, the patient was not sensibly better, in a few hours the vein was opened a second time, and immediately after, a blister (as large as the palm of the hand with the fingers) was applied over that part of the belly which was most affected. As I have more than once known the patient relieved in his bowels as soon as he felt the burning of his skin, and at the same time have stools by a purge or clyster, which had been given before without effect, we have reason to believe that the blister acts more as an antispasmodic than an evacuant. This was my common method in the hospital; and if since that time I have made less use of these blisters, it is not from having seen bad consequences from them, but from finding, in private practice, a greater reluctance in the patient to have them upon a part where they are not commonly applied; and also, from their somewhat inter-

names to the rheumatism, as it affects joints, as to give different names to the different diseases of the intestines, from their different seats. This error would be of little consequence did it not lead to a peculiar and different mode of treating diseases according as they were seated in the small or large intestines, or in their internal or external coats.

fering with the warm bath, which though a material article in the cure, was generally wanting in the hospitals of the army.

Next to bleeding, the principal part of the cure depends upon opening the body, which formerly I attempted by clysters, and by giving every hour a pill of aloes, soap and calomel; but afterwards I changed that practice for the more lenient medicines. In this intention, I have given every hour, the size of a nutmeg of an electuary compounded of half an ounce of the *electarium lenitivum*, two drachms of the flowers of sulphur, and one drachm of the creme of tartar, with some syrup.(73) But of late, I have kept more to the use of the *sal catharticus amarus*, recommended to me by Dr. Heberden, who had had several proofs of its good effects in small but repeated doses. Two ounces of this salt being therefore dissolved in a pint of water, I give two spoonfuls every half hour; or one spoonful at shorter intervals, as long as the patient's stomach will bear it, or till he has had two motions. Although this medicine has a disagreeable taste, yet as Dr. Heberden remarked, the stomach will often retain it when more grateful liquors are rejected: a circumstance which might incline one to believe, what has been said of other neutral salts, that they possess some degree of a sedative, as well as a laxative quality. Whether I direct the electuary or this solution to be given, I order a clyster, purely loosening, for assisting the operation: for I never could understand, how parts lying in the center of animal heat, and naturally in a moist state, should be fomented by

(73) The late Dr. Cadwallader of Philadelphia, introduced the use of cream of tartar into general practice in obstinate obstructions of the bowels with great success, in preference to more active purges.

any fluid, in a clyster no warmer than themselves. When I suspect that the obstruction is owing to hardened *fæces*, at first I only use clysters of oil, but at all other times, the following:

℞ *Decocti communis pro clystere* ℥x. *electarii lenitivi, olei olivarum, singulorum* ℥ii. *misce.*

But when the stomach is so much disordered as to throw up either of the above laxatives, I then join some opium to a stimulating purge; a practice which has been long in use here and followed by Dr. Mead.*

℞ *Extracti cathartici gr. xxv. extracti Thebaïci gr. iss. mercurii dulcis sublimati gr. v. misce, fiant pilulæ x.*

These are for one dose, to be given at some interval when the patient, after vomiting, complains of the least sickness. The smaller the pills are, they will have the better chance of being retained. About twelve hours after this, or when the force of the opium begins to go off, I endeavour to promote the operation of the purge by the solution of the salt as before; and in a few hours more, still continuing the solution, I repeat the clyster.

After procuring stools, most of the danger being over, I follow pretty nearly Sydenham's method, in regard to the rest of the disease; giving laudanum at bed-time; and in the morning, as much of the solution, or of some other laxative, as is sufficient to open the body freely till the hazard of a relapse is past.

Sydenham, in the *ileus* (as he defines it) recommends for the vomiting a scruple of salt of worm-wood in a spoonful of lemon-juice, to be given in the act of effervescence; which practice I remember to have tried more than once successfully in iliacal cases, where the patient only vomited bile; but with this

* *Monit. et Præcept. Medic.* p. 114.

difference, that instead of giving the draught twice a day, I gave it every hour. (74)

With regard to the causes of the *ileus*, it is well known that those who have ruptures are most liable to it; but such cases are not common in the army. As to the other causes, there were too few instances to satisfy me about the most frequent. Not but that among soldiers the bowels are often inflamed; but every inflammation there does not tend to an *ileus*; for by falling upon the larger intestines it generally occasions a flux, as will appear by the dissections of those who died of the dysentery. A few examples may be found of the *ileus* from an inflammation of the *colon*; but I imagine that in most of them, some hardened *feces*, or some tumour, have concurred to straiten the passage and prevent stools. Upon the whole, I have met with this disease more in my practice at home, than abroad in the army. Children and those who are delicate are perhaps more liable to it than men in the vigour of life; besides such as have ruptures are not inlisted. A gouty humour may often be the cause among people of higher rank, but seldom among soldiers. I remember to have had two patients in the *ileus* attended with vomiting; one a young gentleman of two and twenty (who had lived intemperately) whose disorder went off with a fit of the gout; and the other a man of fifty, who in a few days after a second attack was likewise seized with the gout, and afterwards had no complaint in his bowels. Neither of these persons had been troubled with the gout before. But whoever desires to pursue this inquiry farther, may consult the *Sepulchretum*

(74) A substitute for this mixture has been discovered in the æriated alkaline julep, and in artificial seltzer water.

Anatomicum, Ruysch's anatomical and chirurgical observations,* and the late excellent work of Morgagni, *de Sedibus et Causis Morborum*.†

I shall conclude with one remark, which though it has been made before, yet has not been so generally received as to render any further testimony unnecessary. The *ileus* is for the most part attended with a sensible degree of fever, and with all the other symptoms related as above; but besides that there are cases, in which there is no vomiting (as shown from the ancients) there are others in which the fever is scarce perceptible, when the patient feels little pain, and is not altogether costive. I say there are such cases of inflammation; because, when with symptoms so little alarming the patient has died, the bowels have been found not less mortified than after the most distinguishing marks of the disease. This, so far as I know, was first taken notice of by Dr. Simson, whose observation is quoted and confirmed by the Baron van Swieten,‡ and lately by Morgagni,§ who observes, that in such circumstances, the only presages of danger are to be taken from the tension of the belly, and a dull pain upon pressing it, from the lowness and inequality of the pulse, and from a change in the countenance. What he says upon this subject well deserves attention. (75)

* Obs. xci.

† Ep. xxxiv. and xxxv.

‡ Comm. in Boerh. Aphor. § 371.

§ De Sed. et Caus. Morb. ep. xxxv. 22.

(75) A fact of great consequence is here mentioned, and that is, there may be inflammation in the bowels without a sympathy being excited between them and the pulse. In all such cases, whether the inflammation exist in the bowels or in other parts of the body, indications of cure should be sought for from other symptoms, and happily they are seldom absent during the quiescent or passive state of the pulse.

SECTION VII.

Of the Rheumatism.

THE ancients seem to have imperfectly distinguished the gout from the distemper now called the rheumatism, by giving the name of *arthritis* to the affection of all the joints, whether the pain arose from a rheumatic inflammation, or a gouty humour. If not all, but some particular joint suffered, the distemper was denominated from the part; hence the terms *chiragra*, *podagra*, *ischias*, &c. all which they considered as species of the *arthritis*. But as some arthritic pains were observed to be of a different nature from others, they distinguished them according to the different humours which they supposed to be the cause of the disease. Thus, one kind they believed depended on the blood, therefore bleeding was recommended as the chief remedy, and in plethoric habits they bled more than once.

Although by making this distinction, the ancients might sometimes treat in a proper manner that distemper now called a rheumatism, yet as names are so apt to impose upon the understanding, it is to be imagined that the different kinds of the *arthritis* were often confounded, and consequently often unskilfully managed. Accordingly we find, that in later times the physicians came to consider all pains of the joints as the effects of a rheum or catarrh. But this change of theory had a worse consequence; for, all catarrhus humours being supposed to be of a cold nature, bleeding was forbidden, and the cure of an acute rheumatism, as well as of the gout, was then attempted without opening a vein. Botallus seems to have been the first who opposed that practice, and distin-

guishing the inflammatory species of the catarrh (or what we now call a rheumatism) from the rest, declared that repeated bleeding was necessary for the cure.*

But Ballonius is the first whom I find using the term *rheumatism*, to denominate this inflammatory species of the *arthriti*s, which he also conceived to be different from either a gout, or a catarrh.† The same author is also the first who has described the disease in a proper manner, and who has recommended repeated bleeding for the cure. This method has been since followed by the best practical writers, and in particular by Riverius and Sydenham.

How frequently rheumatism occurred, especially in the beginning of a campaign, was seen in the general account;‡ but we must add, that though this distemper sometimes appeared with all the severity mentioned by Ballonius and Sydenham, it was generally of a milder kind. In a high degree of an acute rheumatism the joints are considerably swelled and inflamed, but in our fevers with rheumatic pains that was seldom the case, and therefore the cure was commonly completed in a few days, by twice or thrice bleeding, and by promoting a *diaphoresis* with the cooler medicines, particularly with vinegar-whey. But if the rheumatism was attended with acute pains, or swelling of the joints, the cure was chiefly to be obtained by repeated and almost daily bleedings, till the feverish heat and the pains were intirely removed or

* De Curat. per Sang. Miss. cap. xii.

† We meet with the word *ῥευματισμὸς* in Galen, but in the lax sense of *rheum* or *fluxion*, and not, so far as I know, to denominate any particular distemper. Ballonius begins his treatise upon the rheumatism by calling it *affectus plane ἀνόητος apud antiquos*.

‡ Part i. chap. iii. and chap. iv.

made much easier. And in this course we may proceed the more safely, as those who are subject to this kind of rheumatism are generally in the vigour of life, and are either plethoric, or able to bear such evacuations. Add, that frequent bleedings weaken the body less perhaps in this disease than in any other.(76)

If the pain and swelling of the joints remain after the fever is abated by frequent bleedings, apply three or four leeches to the part where the inflammation and humour are the greatest, and let the blood ooze till it stops of itself. As the relief hereby obtained is sometimes immediate, and the evacuation but small, the repetitions need not be limited.* Ballonius also mentions this practice; and I have had sufficient experience to recommend it to others. But we are to expect little benefit from leeches in such pains of the joints as are not attended with both inflammation and swelling.(77)

In the acute rheumatism internal medicines avail little. In such cases I have commonly given camphire, but not so as to force a sweat.† As to diet, it must be of the lowest kind, as Sydenham well advises.

(76) There is no doubt of the truth of this assertion.

* I have sometimes, since, successfully used twelve leeches every day for three days together, and I make the application as soon as the parts begin to swell.

(77) In soldiers and sailors there is generally but little swelling in the joints affected with rheumatism, probably from the parts being too much debilitated to produce that reaction which enables the blood vessels to relieve themselves by a copious discharge of serum. In these cases local bleeding cannot reach the seat of the disease.

† Although we are not to force a sweat, it will be proper to keep up a gentle moisture on the skin; for which end I have used the camphire in this manner:

℞ *Camphoræ grana* xii. *amygdalas dulces, demptis pelliculis*, ij. *contritis paulatim adijce aque puræ* ℥viiss. *ut fiat emulsio, cujus*

Ballonius mentions pargorics, but without defining the kind, or the times most proper for giving them. Sydenham condemns opiates, as fixing the disease; and, so far as I have observed, justly. Outward applications, excepting leeches, are also to be omitted as long as any fever or inflammation remains. The spirituous and volatile liniments inflame; and the emollient fomentations, though they give ease for a time, do harm by relaxing. (78)

But the chronic rheumatism is one of the most obstinate disorders of the hospitals; being either the remains of a rheumatic fever, or the continuation of pains that proceed at first from neglected colds. In complaints of this kind, if the blood be not sily, we may suspect that the soldier either pretends indisposition, or that his pains are of another nature.* Syden-

colaturæ admisce spiritus volatilis aromatici guttas xl. syrûpi croci ℥ss.

Dentur quarta vel quinta quaque hora cochlearia iv.

During the feverish heat, I order a laxative clyster daily; but when the fever is off, or much on the decline, I give every night at bed-time a scruple of gum *guaiacum* dissolved with the yolk of an egg, in a draught of plain water sweetened with sugar; by which means the patient has generally one or two loose motions next day. This method I continue, after leaving off the camphire, till he gets well. To the *guaiacum* draught I sometimes add a few grains of salt of hartshorn to keep up a perspiration, without weakening its laxative quality.

(78) Where there is much pain with or without swelling, the editor has found the application of cabbage leaves as recommended by Dr. Sydenham to afford great relief, and never to do any harm.

* In our hospitals, the rheumatic pains were always attended with sily blood. This mark however of a rheumatism is not constant; as I have since seen persons with the same complaints, under no temptation to deceive, without any visible alteration in their blood.

ham has also described this species, wherein, though there be no fever, he recommends bleeding; which practice I followed, and often found efficacious. The patient therefore once in eight or ten days lost about eight ounces of blood, as long as it was sisy, or his complaints remained. Between whiles, I purged him with a solution of gum *guaiacum* in a larger dose than in the *formula* above; and on the intermediate days I gave him twice or thrice in the day 50 or 60 drops of the spirit of hartshorn in a draught of water. The tincture of *guaiacum* of the dispensatory contains so little of the gum, that we must ascribe most of its virtue to the volatile salt. (79)

This was my practice in the hospital; but since that time having seen great good effects from the gum *guaiacum* used only as a laxative, in these cases therefore I give it in solution, with five grains of salt of hartshorn, every night at bed-time; and bleed or not as I see occasion.

When the joints are swelled and inflamed, leeches are to be used as before; but when there is no inflammation, the aching parts are to be covered with flannel. In general I have found little benefit from any other external application, except leeches or blisters. After the patient has continued some time in this course, his recovery will be quickened by the use of the cold bath, or the bark;*(80) and to those who can afford it, riding is a specific remedy.

(79) There is a chronic rheumatism common to sailors, in which there is no heat nor swelling in the joints, but which yields only to small and frequent bleedings. The editor has called it rheumaticula, to distinguish it from that torpid state of the joints which has obtained the name of rheumaltigia.

* Some physicians have given the bark in acute rheumatisms (after plentiful bleeding) as soon as a sediment appeared in the

By this method I have found many cured: but I must acknowledge, that several slight cases in appearance, have withstood these and all other methods which I could think of. Sometimes venereal pains may be mistaken for rheumatic; at other times the two may be joined. A salivation does not cure a chronic rheumatism; but there are cases which will yield sooner, if once or twice a week we give a large dose of calomel over night, and purge it off the next morning.*(81)

Some of the more obstinate pains may be of that kind which Sydenham calls the scorbutic rheumatism; or others, more properly, the *arthritis vaga*, or flying gout. For though the common men, and especially at their time of life, very rarely have the true gout; yet, by irregularities, or diseases, the humours may tend

water; though some degree of fever remained, and the pains were still considerable. I have had some success myself in giving it so early, but have not seen cases enough to recommend the practice to others.

(80) It is possible the bark may be given with advantage in the feeble acute rheumatism of soldiers and in others previously worn down to a state of great debility by labour. The editor has used it, always with safety, and sometimes with advantage in the convalescence from the acute rheumatism which occur in the United States.

* In obstinate cases, without fever, Riverius recommends large and repeated doses of calomel joined to a purgative. *Prax. lib. xvi. cap. iii. & Observat. cent. iii. obs. xli.* And others have found the same preparation answer, in alterative doses, continued for some weeks. But as the venereal pains are so often confounded with the rheumatic, it is perhaps chiefly in the former that the mercurials have been found so efficacious.

(81) Let not the languid state of the pulse be considered as an objection to occasional purging in a chronic rheumatism. The purges are not intended in these cases to reduce the system, but to invite the disease from the joints to the bowels by inducing in them an artificial debility.

that way without producing any regular fit. Of what kind those pains may be that are sometimes felt after ill formed and obstinate intermittents, I cannot determine. Sydenham believes them to be owing to the bark; but they were certainly taken notice of by Bal-lonius before the use of that medicine.

The sciatica of our hospitals is almost always of the rheumatic kind; and therefore, if recent, yields to bleeding, blistering upon the part, and the *guaiacum*. But if the distemper is of a long standing, or the cause gouty, the matter will lie too deep for a blister, or any of the common medicines. I remember two cases in the hospital, in which the pain was exquisite and constant, and nothing gave relief; so that the men, after growing hectic, and long pining, died in agony.* (82) The late Dr. J. Clerk of Edinburgh acquainted me, that he had known obstinate sciaticas, both of the rheumatic and arthritic kind, cured by a long continuance of soap taken to the quantity of four or six drachms daily.†

* From other cases which I have seen since, I am induced to think that these men had a suppuration about the hip joint.

(82) The editor has seen a fatal hectic fever from rheumatism in the knee joint, where there was no appearance nor suspicion of suppuration.

† Since the two first editions of these observations, I have used in the rheumatism (when there was no fever) Dr. Dover's powder, giving for some nights about 20 or 25 grains of it at bed-time, with plenty of some warm diluting liquor, and laying the patient in blankets; for the composition, see the treatise called *The Ancient Physician's Legacy to his Country*.

T

CHAPTER III.

Observations on Coughs, and the Phthisis Pulmonalis.

WITHOUT entering into the general consideration of these disorders, I shall only take notice of such cases as I have found most frequent in the army.

Coughs and consumptions are properly annexed to inflammatory diseases. For, a recent cough from cold may be considered as the lowest degree of a peripneumony; and an old and neglected cough as the beginning of a consumption.

Obstructions of the lungs are succeeded by tubercles and ulcerations. In the bodies which I dissected of those who died of the *phthisis pulmonalis*, I found the lungs adhering to the *pleura*, and full both of tubercles and ulcers.

We ought therefore to be careful in removing colds in the beginning. But this part belongs to the regimental surgeon, who is first applied to, and who may be assured that a cough is bad indeed when a soldier complains of it. The disease being of an inflammatory nature, bleeding is the chief remedy, which alone will frequently cure bad colds, whilst all other medicines may be ineffectual without it. Recent coughs, after bleeding, are softened by a mucilage of linseed, by *sperma ceti*, or by any common sweet oil.*

* I observed that the oils had a better effect when joined to a pretty large quantity of a volatile alkali:

℞ *Salis cornu cervi* ℥β. *solve ex aquæ puræ* ℥vij. *dein admisce olei olivarum (vel amygdalarum dulcium)* ℥iβ. *sacchari albi* ℥β.

Sumantur ter quaterve die cochlearia iv. agitata prius phiala.

Besides

When the obstruction is of a long standing, oily medicines are not only useless, but by relaxing the stomach may increase the disorder.

In older and more stubborn coughs, or in the first stage of a consumption, when the patient complains of pains in his side, constriction at the breast, or of hot and restless nights, I have trusted most to small but repeated bleedings, to setons, and to a low and cooling diet.

I have found these small bleedings not only beneficial in old coughs threatening consumptions, but also after hectic symptoms have appeared. The quantity of blood drawn was from four to seven ounces, once in eight or ten days, and sometimes a vein was opened after shorter intervals. It was observable that the patients seldom found themselves so much relieved on the first, as on the second or third night after bleeding. (83) The blood was constantly sisy; but if it had been found in a resolved state, to have insisted upon taking away more would have been improper. Nor would I recommend this method for common practice without making great allowance for the strength of soldiers, nor without suiting the quantity of blood to be let to the condition of weaker patients. In habits naturally weak, or scro-

Besides this the patient, if disturbed by his cough at night, took 6 or 7 grains of the *pilulæ Matthæi* at bed-time; but since that time I have generally, in a draught at bed-time, joined to 15 or 20 drops of *laudanum* about 2 drachms of the *oxymel scilliticum*, or half a drachm of gum *Ammoniacum* (according to the degree of heat, or to the stomach of the patient) in order to correct the binding qualities of the opium. The former of these compositions was communicated to me by the late Dr. J. Clerk of Edinburgh: the latter, by Dr. Simson of St. Andrews.

(83) This remark should be deeply imprinted upon the minds of young physicians, otherwise they will be deterred from using, and repeating the bleeding, and at a time when it is the only effectual remedy in arresting the progress of consumption.

fulous, or when the patient has been long in a decay, bleeding, like all other means, will be ineffectual.

But I can more freely recommend from repeated trials the use of a seton, made in the side upon the part most affected.

In thirst, heat and other symptoms, the signs of a putrid state of the humours, the pisan is to be acidulated, and the aliments ought then to be all of the accrescent kind. Buttermilk is particularly good. And, if possible the patient ought to be confined to a milk and vegetable diet.

I have found nothing diminish the hectic fits so much as small bleedings and a cooling diet. (84) Colliquative sweats are sometimes checked by lime water, and sometimes by the *elixir* of vitriol. (85)

In the advanced state of a consumption, we may distinguish two sorts of coughs, one caused by the ulcers, and the other by a thin rheum falling upon the *fauces* and *trachea*; which parts being then deprived of their *mucus* become sensible of any irritation: and this last kind is perhaps the most painful and teasing to the patient. The same medicines are not proper for both: For the first sort I have used the balsam of Peru, but did not find it more efficacious than the capyvi. Of this last I commonly gave about ten drops, twice a day, in a bolus of conserve of roses. *

(84) Experience has confirmed the truth of this assertion in many hundred instances.

(85) The Editor has used lime water with advantage in restraining the distressing night sweats which attend the hectic stage of pulmonary consumption. He has likewise advised a small teaspoonful of the fine powder of calcined oyster shells, and a few grains of the powder of agaric to be taken at bed-time with temporary benefit. He has once known them checked by promoting a large discharge of urine by the patient's eating plentifully of watermelons.

* Having since the former editions of this work, been so often

The other kind of cough can only be palliated by incrassants, and for that purpose I have commonly used the conserve of roses, and opium. The former is always safe, and otherwise well adapted to the nature of the disease, but of weak virtues; the latter is the most efficacious; but is to be given with caution, considering how apt it is to affect the head, to bind the body, and to obstruct expectoration. However, as these bad qualities are in some measure to be corrected by squills, as soon as the patient begins to complain of restless nights from coughing, I have usually prescribed a draught with a drachm and a half of the *oxymel scilliticum* and fifteen drops of the *tinctura Thebaica*, to be given at bed-time; and have increased the dose of each ingredient when there seemed to be occasion for it.

I never gave the bark in any stage of the consumption, unless in the convalescent state, when the lungs seemed to be free from obstruction.*

disappointed in the effects of such balsams in this distemper, I have laid them all aside, and trust chiefly to small but repeated bleedings (when the patients can bear the loss of blood), to a total milk or vegetable diet, to a seton in the affected side, to country air and riding, and to the free use of acids when they complain of thirst and hectic heats. (86)

(86) This summary mode of treating pulmonary consumption, should be confined only to its inflammatory state. In its typhus state, not only balsams of all kinds, but the most cordial aliments and drinks, the latter, in such quantities as to keep up a tendency to intoxication, have been used with success. The records of the Pennsylvania hospital contain a number of cures performed by these stimulating remedies.

* I have frequently, since, given three or four spoonfuls once or twice a day of a decoction or an infusion of the bark, without observing it to heat or obstruct the breathing; but on the contrary, to have a good effect when the patient has complained of low

Riding and asses milk, the two common resources, are wanting in military hospitals: what is still worse, the air of such places, or of full barracks, is contrary to the cure. Hence it happens, that though these means may often succeed with men better accommodated, they will generally be frustrated by the foul steams the sick breathe there: and though a soldier may chance to escape their bad effects and recover, it is odds but he relapses, by being exposed to colds as soon as he returns to his duty.

In this manner I have treated the *phthisis pulmonalis*. I have likewise observed much benefit to arise from small and frequently repeated bleedings in the cure of wounds, when matter has been absorbed, and a hectic fever brought on. (87)

spirits and weakness, and has not been in the last stage of the distemper.

(87) To the remedies mentioned by our author for consumption, modern physicians have added a salivation. It has succeeded in all its states, but chiefly after the inflammatory diathesis of the system has been reduced by bleeding and other depleting remedies.

CHAPTER IV.

Observations on the Fevers called Bilious, or the autumnal remitting and intermitting fevers of the army.

I COME now to consider those putrid diseases, commonly though perhaps improperly called bilious,* which being the most common and fatal to an army, and least known, shall therefore be treated of in a more full and regular manner than the preceding.

The bilious disorders begin about the decline of summer, and become epidemic in autumn, appearing earlier, more general, and with worse symptoms, in proportion to the heat of the season, and to the moisture of the ground and climate. Although of different forms they are of a like nature, and may be reduced to two heads, *viz.* fevers and fluxes.

Beginning with the fevers, I shall first describe that which is frequent in every camp; next, that which seems more peculiar to the marshes; in the third place, I shall inquire into the cause of both; and then compare them with those of other places in the like circumstances: lastly, I shall propose the method of cure which I followed both in the fevers of the camp, and in those which occurred in the marshy parts of the Netherlands. In the next chapter I shall mention such remedies as I found most successful in removing the obstructions occasioned by these distempers.

* Why so called, see part ii. ch. i. part iii. chap. iv. § 3.

SECTION I.

Of the Symptoms of the Remitting, and Intermitting Fevers of the camp.

IN the month of June, the fevers in the camp are fewer and less inflammatory than upon first taking the field; and as the season advances they are attended with still less inflammation, but with more disorder of the stomach and bowels, and with pains in the head; and they have all a sensible remission. This change, just perceptible after the solstice, becomes manifest by the end of summer, or the beginning of autumn.

This epidemic differs according to the nature of the ground, and therefore I shall distinguish it into two species; one, incident to an army on dry ground; and the other, infesting it in damp and marshy countries. I shall first describe the former.

The bilious or remitting fever of the camp begins with chilliness, lassitude, pains of the head and bones, and a disorder at the stomach. At night the fever runs high, the heat and thirst are great, the tongue is parched, the head aches violently, the patient gets no rest, and often becomes delirious; but generally in the morning, an imperfect sweat brings on a remission of all the symptoms. In the evening, the paroxysm returns, but without any cold fit, and is commonly worse than the former: next morning it remits as before. These periods go on daily till the fever if neglected, changes insensibly into a continued form. Sometimes loose stools carry off the fit and supply the place of sweats.

Although this fever in many particulars resembles an intermittent, yet it is somewhat of a different nature, as shall be more fully shown when we come to the cure.

In the camp we seldom meet with a regular intermit- tent either in a tertian or quartan form, unless in the case of a man who was ill of one before he took the field.

The remissions usually appear from the beginning, and especially if the patient is bled on the first attack: sometimes they are little perceptible for the first two or three days. Hæmorrhages of the nose, at the height of the paroxysm, generally bring on the remission sooner and make it more complete. Vomiting or purging have the like effects. But I remember no natural evacuation making a cure at once, unless when a *cholera* supervened, that is, a violent discharge both ways of the corrupted humours which seemed to be the cause of the disease.

The fits are seldom preceded by shiverings, or any sense of cold, after the first attack. The pulse is full and quick during the paroxysms, and in the remis- sions it still indicates some degree of fever. The blood is florid, the *crassamentum* is firm, in a large quantity, and sinks in the *serum*. The blood shows no great sign of inflammation in the beginning of the epidemic, but towards the end of the campaign it acquires a sizo crust; for by that time, to the other symptoms are joined either stitches, rheumatic pains, or a cough.(88)

Whilst the weather continues warm, the marks of a foulness in the *primæ viæ* are most frequent; but as winter approaches, the inflammatory symptoms pre- vail.

The urine is high coloured and crude till some eva-

(88) Our author errs in estimating the violence of a fever by a sizo crust upon the blood. Its florid colour, and the crassamen- tum sinking in the serum, indicate a higher grade of disease, and call for a more prompt use of the lancet than the sizo crust.

cuations have been made, and then it begins to break. What is voided by vomiting, or by stool, is generally of a bilious and corrupted nature. Costiveness not only often precedes but accompanies the disease, and when that happens the belly feels hard, and the patient complains of wind. Although all do not vomit yet every one feels a disorder at the stomach, especially during the hot weather.

Worms come away frequently by stool, sometimes by vomiting. They are of the round kind, and those who are troubled with them have more obstinate gripings, or sickness at the stomach. In such cases, stitches are frequent; but these being often of the flatulent kind are not always relieved by bleeding.

Some grow yellow as in the jaundice. This colour was observed to be more frequent during the first campaign than afterwards: it was an unfavourable, but not a mortal sign. One of the regimental surgeons told me, that he had opened the body of one of his men who died with this symptom, but had discovered no *calculus*, nor any kind of obstruction in the gall-bladder or in the biliary ducts.

The infantry were more subject to the fever than the cavalry; and these last, more than the officers: this seemed to be owing to the difference of clothing and accommodations.*

There were no critical days, nor any certain duration of the distemper, which was longer or shorter, according to the manner of treating it.(89) It could not be called dangerous, when timely and proper means were used; but this fever is often fatal to an

* Part i. chap. iii.

(89) The power of nature over the system in producing critical days, appears to have been destroyed by the habits of a soldier's life.

army, when so many are seized at once as cannot be properly attended; or when it changes into a continued or malignant form, either by neglect at first, or by crowding too many who are ill of it into the same hospital.

This remitting fever attended every campaign, and was most frequent and fatal after the hot summers of the years 1743, and 1747; but in the campaigns 1744, and 1745, the seasons being temperate, fewer were seized, and the cases were milder.

SECTION II.

Of the Symptoms of the Remitting, and Intermitting Fevers in low and marshy countries.

THIS *species* of the putrid fever was mentioned in the general account of the diseases, most incident to the Netherlands,* and also in the account of those which occurred during the two last campaigns;† but the full description was reserved for this place.

We are first to observe, that though all moist countries are subject to intermittents, yet if the moisture is pure, and the summers are not close and hot, the fevers will mostly appear in a regular tertian form and be easily cured. (90) But if the moisture arises from stagnating water, in which plants, fish, and insects die and rot, then the damps being of a putrid nature not only occasion more frequent but more dangerous fevers, which oftener appear in the form of quotidians, or double tertians, than in that of single ones. These marsh-fevers are not only apt to begin with little remission, but after intermitting for some

* Part i. ch. i.

† Part i. ch. vii. and viii.

(90) There can be no doubt of moisture alone being one of the remote causes of fever.

days, to change again into continual fevers of a putrid and malignant nature. It is remarkable how much they vary with the season; for however frequent, violent or dangerous they have been in the decline of summer, or beginning of autumn, when the putrefaction is at the height, yet before winter they are reduced to a small number, become mild, and generally assume a regular tertian form.

The first kind were observed to prevail near the inundations in Dutch Brabant;* the next, were those of Zealand;† of the third degree, were those in the lines of Bergen-op-Zoom;‡ and the mildest sort, were such as were most frequent in the cantonments around Eyndhoven,§ in villages rendered moist by plantations, and subterraneous water, but not putrid. I shall describe the first and worst kind, from which it will be easy to judge of the nature of the rest.

In the end of July 1748, when the troops had been a fortnight or three weeks in the cantonments, whilst the days were sultry, but the nights cool and foggy,|| several of the men (of those regiments which lay nearest the inundations) were seized at once with a burning heat and a violent head-ach; some feeling a short and slight chilliness before the attack, others mentioning no preceding disorder. They also complained of intense thirst, aching of the bones, a pain of the back, great lassitude and inquietude, frequently of a *nausea*, sickness, or a pain about the pit of the stomach, and sometimes they vomited green or yellow bile of an offensive smell. The pulse upon the first attack was generally depressed, but rose upon bleeding. There were some instances of the head

* Part i. ch. viii.

† Ibid. ch. vii.

‡ Ibid. ch. vii.

§ Ibid. ch. viii.

|| Ibid. ch. viii.

being so suddenly and violently affected, that without any previous complaint the men ran about in a wild manner, and were believed to be mad, till the solution of the fit by a sweat, and its periodic returns, discovered the true nature of their *delirium*. (91)

Some time after, Dr. Stedman, then surgeon to the Greys, acquainted me: "That two of the men
" who were first taken ill were seized at once with
" symptoms of an ardent fever, and though they were
" speedily and plentifully bled, yet in an hour after,
" both were in a high *delirium*, which continued for
" some hours and then went off with a profuse sweat,
" under which all the other symptoms either abated
" or vanished. That next day about the same hour
" the paroxysm returned, and in six or seven hours
" ran the same course. That in this manner the fever
" affected many of that corps, whilst some of them
" had less distinct paroxysms, the hot fits longer, and
" those followed by imperfect sweats with little relief.
" That sometimes the remissions were so impercep-
" tible, that the disease appeared almost in a continued
" form. That the nearer it approached to this last state
" it was the more intractable; but that when the parox-
" ysms were distinct, with an intermission of some
" hours between them, the patients for the most part
" did well, however great the *delirium* was during
" the fever. That a few returns of the paroxysms re-
" duced their strongest men to so low a condition as
" to disable them from standing. That some became
" at once delirious without any previous complaint,
" and would have thrown themselves out of the win-
" dows, or into the water, if not prevented; that their

(91) Fever, when accompanied with this symptom, has been called the maniacal state of fever. it is very properly distinguished from mania by paroxysms which terminated in sweats.

“ frenzy continued for some hours, after which falling into a profound sleep, they awaked quite sensible but with a violent head-ach. That others, whose fever appeared in a continued or remitting form, had critical sweats about the ninth day, and afterwards regular paroxysms and intermissions. That a few had a crisis by stool or urine. That there were some who were ill about three weeks without any sensible remission, after which the fever ended with some quotidian paroxysms, and that these men during their illness had gentle sweats, or rather a continual moisture upon the skin. That many upon being first taken ill had bilious vomitings; and that several voided round worms both ways. That the profuse sweats had always a putrid smell; and that the discharge from the blisters was so offensive, that the nurses declined dressing them. What was most remarkable, a few of those who died were observed to have a regular pulse, though very near their end. (92) That all those who died had a cadaverous smell (93) for some days before death, and immediately after, livid spots and other signs of a mortification.” Dr. Stedman concluded with observing, that “ the same distemper was also common among the peasants of the cantonments in the neighbourhood, and that a great number of them died.”

This account of the beginning of the epidemic being so full and distinct, I need only add, that it agreed with the observations of all the other regimental surgeons in the like situation, allowing for some

(92) A regular pulse attended the last stage of the yellow fever in Philadelphia in many instances.

(93) The editor has known but one instance of a recovery from a malignant fever, in which this cadaverous smell took place.

variation according to the different circumstances of those corps. Thus Mr. Lauder, surgeon to the Iniskilling regiment, then Lord Rothes's, informed me, "that most of the men were first taken ill upon their return from forage: for, the regiment being cantoned upon the right and left of St. Michel's Gestel (their principal quarters) close upon the inundations,* and many of the quarters being above two leagues from Bois-le-duc where the magazines were kept, the men were obliged to set out about four in the morning, in order to get back before the greatest heat of the day. That at this early hour the meadows and marshes on each side of the road were covered with a thick fog of an offensive smell, which he considered as the chief cause of the sickness. For though the party generally returned before noon, that several among them were already in a fever, and some actually delirious; nay, that a few on their way home were so suddenly taken with a frenzy, as to throw themselves from their trusses into the water, imagining they were to swim to their quarters. That from the first attack, as many of them as were sensible complained of a violent headache, thirst, and burning heat; and that all of them, attempting to sit up, were ready to faint away with a giddiness, sickness at stomach, and retching to vomit. That these fevers were for some days of a continued form, or at most had slight remissions; after which they either remitted more plainly, or thoroughly intermitted. That at first the pulse was small and depressed (though the patient was then delirious) but that it always rose upon bleeding." Mr. Lauder told me, about three years after this sick-

* Part i. chap. viii.

ness, that two of those men, who were so suddenly taken with a frenzy on their return from foraging, though they recovered of their fever, had ever since been epileptic; and that all the rest, who had been ill, were still liable to returns of an intermitting fever.

The condition of the foot was somewhat different, for few of them being cantoned near the inundations, their fevers though frequent were generally of a milder nature; yet some of those corps had the sickness also in a high degree, occasioned by the moist and corrupted air of their quarters. The village of Dinther* lay low, and was surrounded with ditches and thick plantations. Mr. Tough, surgeon to the battalion there, observed: “ That the meadows were every evening overspread
“ with a fog, which continued till next morning after
“ sun rise, and which had the offensive smell of a foul
“ ditch newly drained. That the men were commonly
“ taken ill in the night-time with a shuddering or sense
“ of cold, which was soon followed by a violent head-
“ ach, intense heat, and other feverish symptoms.†
“ That at this time the pulse was so small and de-
“ pressed, that if a vein was opened the blood at first
“ would scarce run out, but that after some vent it
“ flowed briskly, and then the pulse rose. That a
“ profuse sweat succeeded the heat, and with that a
“ remission, or intermission of the fever. That the
“ paroxysms returned every evening, and if care were
“ not soon taken to stop the fever, it was apt to change
“ into a continued form with malignant symptoms.
“ That in three cases he observed petechial spots;

* Part i. ch. viii.

† It is to be remarked, that the dragoons having better pay generally hired beds of their landlords, or at least lay warm in their cloaks: but that the foot soldiers wanting these advantages, lay in barns and other damp places without any covering.

“ and in a fourth, a mortification under the left breast,
 “ which however was cured by the bark. Lastly, that
 “ there was one instance of a man, who being sud-
 “ denly seized with the usual headach, and not imme-
 “ diately bled, got out of his quarters and ran about
 “ the fields like one distracted.”

In the greatest heat of the weather and rage of the distemper, most of these fevers answered the description of the *κᾶνσος* or ardent fever of the ancients, which Hippocrates does not rank with the inflammatory diseases of the winter and spring, but with the bilious epidemics of summer and autumn,* though later writers have applied this term to all fevers attended with great inflammation.

But it was observable, that even in the worst parts of that country, as soon as the weather cooled in the decline of autumn, the fevers began to assume a milder form; and in the end of the season, differed little from the common intermittents of other places.

There were but few quartans, and those did not appear till late, nor were they hard to cure unless when they succeeded to some other form of this fever, which had already produced obstructions in the *viscera*.

When the sickness was at the worst many voided round worms, which were not the cause of the fevers,

* Aphor. lib. iii.

The ardent fever of the ancients was either continued, or remittent; of which last Gorræus gives the following description: “ *Est ὁ κᾶνσος tertianæ febri ὁμογενής, ut quæ ab iisdem causis, eodem anni tempore & iisdem corporibus provenit, a quibus & tertianæ febres excitari solent. In tertiana intermittente primum rigor, deinde ἀπνεξία est: verum ardentis exacerbationes nullo cum rigore fiunt, nec unquam integre solvuntur, sed modice tantum remittuntur.*” *Definit. in voce Κᾶνσος.*

but, as we observed before, concurred with other circumstances to retard the cure.

At the height of the epidemic it appeared, that both intermittents and remittents, by extending or doubling their paroxysms, frequently changed into a continued, putrid and dangerous form, and that most of those whom we lost died in this way. These men, as we remarked, had a corrupted smell for a day or two before their death, and soon after it their bodies mortified. Some had petechial spots, though the place where they lay was neither crowded with sick, nor too close; and to these spots were added some other symptoms, the same with those of the hospital-fever.

But in general, the mortality was not in proportion to the number of the sick, nor to the alarming nature of the symptoms. Although the distemper was violent, yet it yielded to medicine, and no kind of acute disorder seemed to require it more; for a great number of the country people perished for want of it, whilst most of our men recovered by the care of their regimental surgeons. Of the Greys and Rothes's dragoons, who were the most sickly, 31 died in all; which will not appear a considerable number, if we reflect what a multitude of bad cases there were (and those much dispersed) and how few to attend them.*(94)

One of the most unfavourable circumstances was the proneness to a relapse, the danger of which was greatest during the hot weather, less in the decline of autumn, and least of all after the frosts began. But in the following spring, relapses became so frequent, that

* Part i. chap. viii.

(94) Let sceptics in medicine, and the advocates for the healing powers of nature be dumb, after reading the different issue of the bilious fever, described by our author in the two preceding paragraphs.

those regiments, who had served in Zealand in the preceding autumn, had in the next campaign above four times more sick than any other corps in the line.

Frequent relapses brought on visceral obstructions, which made the intermittents more obstinate and irregular, and terminate in a dropsy, or jaundice. In this bad state of the *viscera*, a hard tumour was frequently felt on the left side of the belly, lower than the false ribs, called by the common men the *ague-cake*. But as none of those who died with this tumour were opened, the part affected could not be ascertained. I conjectured it to be the spleen. It was often accompanied with swelled legs, a distension of the whole belly, or with some other hydropical symptom; and whilst it remained, the fits could not be safely stopped by the bark. It was a bad but not a mortal sign, since many who had it recovered.

I likewise met with a few cases of the *tympanites*, a distemper which I suspected to be chiefly owing to a premature use of the bark before proper evacuations. But as to other obstructions, and in particular those which brought on the *ascites*, I observed that they happened as often without, as with the bark, and therefore seemed generally to depend on the long continuance and obstinacy of the intermittent.

It was remarkable, that whilst the sickness raged among the common men, it appeared in a mild degree among the officers, who seldom had the fever in a continued form, or attended with malignant symptoms, but in the shape of single and double tertians, or of quotidian remittents. The reason seemed to be, that they were less exposed to the sun and fogs, that they had drier quarters, better diet, and the use of wine.

SECTION III.

Of the Causes of the Remitting and Intermitting Fevers of the camp, and those of low and marshy countries.

THE heat and moisture of the air appear to be the chief remote and external cause of these fevers; and this cause is most prevalent not only in proportion to the warmth and closeness of the weather, but to the quantity of vapour with which the air is loaded in the drought of summer. Rains in general lessen the moisture of the air by draining it of so much water: and by descending from a colder region, they not only refresh the atmosphere but the earth also, and thereby check immoderate exhalations. The most healthful campaigns have therefore been those in which the heat and moisture of the air were moderated by frequent showers. But if the air in its greatest heat receives not only the aqueous, but the putrid *effluvia* from marshy grounds, or from any large surface of corrupted water, the remote and external cause of sickness will be aggravated, the diseases will be more numerous and attended with more alarming symptoms.

The relaxation of the fibres and greater tendency in the humours to putrefy, consequent on this state of the atmosphere, may be considered as the internal and predisposing cause of these fevers: for, a hot and moist air unbraces the solids, resolves the blood, and obstructs perspiration. When the air is filled with vapour, it admits the perspirable matter with difficulty; and when part of that is retained, the blood not only thereby receives a septic ferment, but is more heated by having less evaporation. Nor can the want of a free perspiration be supplied by sweating, as

sweating tends to weaken the body and render it more subject to disorders.

Although these two causes may be sufficient of themselves to produce this fever, yet for the most part a third is wanting to bring on the disease: this is called the *exciting* or *occasional cause*, which always arises from some error in the non-naturals; such as heating the blood by fatigue, intemperance, or insolation; or by suddenly checking the perspiration by improper food, wet clothes, lying on wet ground, &c.

To these last errors in regimen Sanctorius must allude, when he refers the causes of the autumnal tertian fevers to a stoppage of perspiration; and we can scarce doubt of the justness of that observation, though from Keil's Tables it would seem, that this excretion may not only be diminished, but for some time wholly suppressed, without any injury to the health.(95) But we are not to compare the ordinary checks given to perspiration in this country (where the weather is seldom close and hot for any considerable time) with what happens in other climates subject to such intemperature, where the inhabitants having in summer and autumn long and uninterrupted heats (and by that means blood of a more putrescent nature) require a more constant evacuation of what is recrementitious. Sanctorius himself says, "that such a stoppage of perspiration as in summer might occasion a malignant fever, will in winter scarce affect the health."*

(95) In a vigorous constitution the perspiration when obstructed is conveyed out of the body by urine, stool, or an increased exhalation from the lungs. It is only when the body is debilitated that the perspiration is retained, and disease thereby induced.

* *Adiapneustia, quæ æstate malignam febrem, hyeme vix minimam alterationem efficere potest: corpora enim acriori perspirabili æstate referta sunt quam hyeme. Med. Stat. sect. ii. aphor. xxxv.*

Thus far we have endeavoured to trace the remote, the predisposing, and the occasional causes of these fevers, and it were to be wished that with the same probability we could explain their *causa proxima* or immediate cause, that is, could show how these vitiated humours act upon the vital principle, so as to excite a fever of a remitting or intermitting form, accompanied with such symptoms as were mentioned above. But in these researches, as so much depends upon the action of parts which have laws peculiar to themselves and are imperfectly known, it seems better not to form an hypothesis at present, but to wait till further discoveries be made in the animal economy.

These fevers have been long called *putrid*, and not without foundation; since, from what we have observed, there seems at this time to be such a disposition in the humours to putrefaction. They have still more anciently been distinguished by the name of *bilious*, but with a more disputable propriety; as the first authors did not confine that term to the appearances only, but extended it likewise to the cause of the disease. Yet it was no wonder that the ancients should believe that these fevers arose from bile, when they observed that nature cured them by a *cholera* or violent discharge of the gall both ways; and that physicians could also succeed, in the same manner, by a vomit and a purge. But after all, the bile seems to be more the effect than the cause; for whenever these fevers come to fair intermissions they give way to the bark, a medicine which so far as we know has no direct influence upon that humour. All therefore that can be said, in favour of the ancient doctrine is, that though the bile be not the first cause, yet, from its redundance and depravation, owing perhaps to the fever, it frequently be-

comes a secondary cause of irritation and supports the disease.(96)

I should now proceed to the cure, but as it may be proper to examine these principles, by considering what form the summer and autumnal disorders assume in other places, under the influence of a warm, moist, and putrid air, I shall produce a few instances for this purpose from such authors as seem to have made the proper observations.

SECTION IV.

The Remitting and Intermitting Fever of the Camp and Cantonments compared with the Summer and Autumnal Fevers of other places.

I SHALL begin with the *morbus Hungaricus*, a disease frequently mentioned by authors, but, as I imagine, not thoroughly known. It is described as a malignant fever, attended with sickness at the stomach, a pain and hardness about the epigastric region, great thirst, a parched tongue, and a constant headach ending in a *delirium*. These were the common symptoms, to which were generally added petechial spots, or blotches. This distemper was contagious and mortal, though it usually run out from 14 to 20 days. It was first taken notice of in the year 1566, in the imperial army in Hungary, and from thence it spread over a great part of Europe. As I have read no author who was an eye-witness, I shall take the liberty to infer from this account, which we have from Sennertus,* that the Hungarian disease was a compound of the bi-

(96) This remark is correct, nor is this the only instance in which a disease is increased by its effects. Sometimes the effects of a disease, become the cause of many other diseases.

* De morbo Hungarico.

lious and hospital-fever, taking its rise in the camp, but acquiring that high degree of malignity from the foul air of the places in which the sick were crowded.(97) It appears that the climate there is one of the worst for an army in the field; which is easily understood, from the cold and damp nights that succeed the sultry days in a marshy country.* And since the au-

(97) There can be no doubt of the miasmata which produce the bilious and hospital fevers, acting at the same time upon the body. Dr. Monroe & Lempriere mention instances of it. A fever thus formed, has sometimes become contagious, which Lempriere says has led to the erroneous belief that the bilious yellow fever spreads by contagion.

* The moisture of that country is to be understood only of such low parts of it as lying upon the great rivers, particularly the Danube and Drave, are exposed to frequent inundations. For, the land-floods form marshes, and these corrupting begin to infect the air about the end of summer. The rest of Hungary is said to be dry and healthful: but the campaigns being always made near those rivers, the troops on that account have been generally sickly.

Dr. Brady, physician-general to the Austrian army, who served three campaigns in Hungary, informed me, that upon the drying up of the inundations, he has seen large tracts of those grounds swarming with aquatic insects; and he confirmed the above account of the moisture of the air, and of the remarkable difference between its temperature by day and by night. Now, the sudden changes from heat to cold are not only to be ascribed to the damps (the air after sun-set being always colder in proportion to its moisture) but, according to that gentleman, to the winds blowing from the Carpathian mountains, which are some of the highest in Europe and constantly covered with snow. These lying at so great a distance, he supposed that the stream of air from that quarter was in the day-time thoroughly heated before it could reach the camp, but which could not happen after sun-set.

Dr. Brady also told me, that the description here given of the bilious fevers of the marshes agreed with the observations which he had made of the autumnal fever incident to the queen's troops in Hungary, not only with regard to the symptoms, but to its cure by the bark, which he, the first of any Austrian physician,

tumnal fevers and fluxes are more frequent and worse in Hungary than elsewhere, in order therefore to account for the great mortality and pestilential nature of this epidemic, we need only suppose that the weather in that year was more than ordinarily unwholesome throughout Europe, that the sick were crowded together, and that the dead frequently lay unburied.* But these reflections will be better understood after considering the nature of the jail or hospital-fever, to which class this disease may in part be referred. We shall therefore proceed to examine some other epidemics of a less doubtful nature.

At Copenhagen, in the year 1652, a fever began in autumn after an unusually hot and dry summer.† That city is situated in a low and moist country. The fever was accompanied either with quotidian or tertian paroxysms, with bilious vomitings, a burning heat, violent head-achs, often with a *delirium*, and with petechial spots which came out in the fits and disappeared in the remissions. These spots, with an extraordinary debility, showed the malignant nature of the disease, which was further ascertained by the fever's ending in profuse sweats, abscesses, a *diarrhœa*, or dysentery. The author of this account, Thomas Bartholine, upon dissecting the bodies, and finding the stomach

had given in that distemper. And he added, that the course of the other military diseases, both there and in Bohemia, had been similar to what he found (by reading the first edition of these Observations) had occurred in our campaigns in Germany and in the Low-Countries.

* This very circumstance is mentioned by Sennertus. *Vid. loc. cit.*

† Bartholin, *Histor. Anatomic. Rar. cent. ii. hist. lvi.*

and *duodenum* always inflamed or mortified, assigns to these parts the seat of all malignant fevers.(98)

In the year 1669, a like fever raged at Leyden, described by professor Sylvius de le Boe,* who lived at the time, and practised there. The situation of this place is also low and damp. The spring and beginning of summer were cold, but the remainder of summer, and the autumn were unusually hot, with little or no rain, and with a constant calm or stagnation of the air. The water of the canals and ditches were highly corrupted, and the more so, as the author observes, by an inlet of salt water mixing with the fresh.† The air being thereby rendered more impure brought on an epidemic fever of a remitting, or intermitting form, and very fatal. Besides a disorder of the stomach, great anxiety, bilious vomitings, quotidian or tertian paroxysms, and other symptoms the constant attendants of this illness, he mentions spots, oozing of blood from the nose and hæmorrhoidal veins, dysenteric stools, putrid urine, great debility, *aphthæ*, and other appearances which argued an uncommon resolution and putrefaction of the blood. And yet, which is strange, Sylvius ascribed the cause to a prevailing acid,‡ and treated the distemper accordingly:(99) so that we cannot help remarking, that the great mortality

(98) We see in the history of this fever its sameness in its causes, symptoms, and in the appearance of the stomach after death, with the American yellow fever.

* Prax. Med. append. tract. x.

† The reasons of this may be learned from the experiments in the Appendix, paper iii. and iv.

‡ Sylv. Prax. loc. cit. DCXXXVII.

(99) The same opinion has been revived in this country. Happily however, it has not led to the exclusive use of the same remedies for the cure of the fever, which has been supposed to arise from this morbid acid.

among the principal inhabitants of that city (of which he says, two thirds died) might have been owing, in some measure, to the method of cure by absorbents, and other medicines, agreeably to the notion which that ingenious and learned man and his followers entertained of its cause.

These and other instances of the same kind may confirm what was observed before, of the danger arising from hot and dry summers to moist and low countries.*

But the putrid diseases are still more frequent and fatal in the marshy countries of the south, where the heats are longer and more intense. In some parts of Italy, and in other tracts of the same latitude, these fevers have appeared with such dangerous and putrid symptoms, as not only to have been called pestilential, but confounded with the plague itself. In this sense we are to understand Celsus,† in the terms *pestilentia* and *febris pestilentialis*, which he describes as peculiar to the *grave anni tempus* and the *graves regiones*. His meaning is, that the bilious and malignant fever is the disease of the latter part of summer and of autumn, when the air is thickest and most foggy, and that it is most frequent in low and marshy countries.

Rome was always liable to these fevers. Galen calls the *hemitritæa* the epidemic of that city, and speaks of its moist air.‡ Nay, in the beginning of the republic, before the Romans seem to have been aware of the noxious effects of stagnating water, or at least before they knew how to let it off, that place appears to have been so very sickly, that from the beginning of the state to the year U. C. 459, I find fifteen plagues

* Part i. ch. i. Part ii. ch. i. § 2.

† Cels. de Medicin. lib. i. cap. x. lib. iii. cap. viii.

‡ De Temperam. lib. ii.

mentioned by Livy,* which yet, from other circumstances, appear to have been only so many malignant and destructive epidemics occasioned by the putrid *effluvia* from the neighbouring marshes. But when drains and common sewers were made, Rome became more healthful, and then only the low and wetter places of Latium remained sickly. Afterwards, when the city fell into the hands of the Goths, the drains being stopped and the aqueducts cut, the Roman territory became one continued marsh, which for a series of years occasioned an incredible desolation.† And though these evils have been since remedied, yet still, by neglecting to draw off the stagnating and corrupted water (after inundations of the Tyber succeeded by great heats) the malignant remitting, and intermitting fevers become both general and fatal. The dissections made by Lancisius, added to his excellent account of those epidemics, are a full proof of their putrid nature.‡

Although it does not appear that the countries in which Hippocrates practised were either marshy or subject to inundations, yet we find him frequently mentioning these fevers as common in summer and autumn, and as prevailing most when wet springs with southerly winds were succeeded by hot and close summers. A remarkable constitution of this kind is described in his epidemics,§ at which time the diseases were ardent, remitting, and intermitting fevers of a bad kind, attended with fluxes, parotids, and eruptions of a pestilential nature.

Prosper Alpinus observes, that the stagnating canals

* Lancisius reckons up several more from the same author. Vid. *Dissert. de Advent. Rom. Cæli Qualit. cap. iii.*

† Id. loc. cit. ‡ De Nox. Palud. Efluv. lib. ii. epid. i. cap. vi.

§ Lib. iii. § 3.

at Grand Cairo breed every year a malignant kind of smallpox, as also the putrid and pestilential fevers that prevail in March, April and May, which the southerly winds make the hottest months in that country.* He also remarks, that the pestilential fevers are both epidemic and fatal at Alexandria in autumn after the recess of the Nile. They begin with a *nausea*, great sickness at the stomach, extraordinary inquietude, and a vomiting of an acrid bile;† and many have bilious and putrid stools. Now, as these distempers rage in both those cities every year, it is not surprising, if in seasons uncommonly hot and moist they should be raised to a true plague. For, though the learned author asserts, that the true plague is not properly indigenous in Egypt, but is brought thither from Greece, Syria, or the more southern parts of Africa, yet he thinks that it may sometimes begin there after extraordinary inundations of the Nile, when the water, extending itself beyond the usual drains, stagnates and forms some large putrid marshes.‡

Java, lying between 5 and 10 degrees of south latitude, is so near the line, that the seasons are not so properly divided into summer and winter, as into the dry and the rainy. The rains begin in November and continue till May, in which time an immense quantity falls. There are also a great number of marshes and canals with stagnating water at Batavia, and by their exhalation the air is rendered moist, foggy and unhealthful. Bontius observes, that at this time the humidity is great, and that even in the dry months the metals rust,§ and the clothes rot in that country

* De Med. Ægypt. lib. i. cap. xiv.

† The author's phrase is *bilis virulenta*. ‡ Ibid. cap. xv.

§ The rusting of metals is perhaps only an ambiguous sign of moisture in any place near the sea within the tropics. For I have

sooner than in any part of Europe. Nevertheless, the plague is unknown in Java, though from these circumstances one might expect that this island should be greatly exposed to it.(100) But we are to consider, that when the sun is most vertical in that country, it is also most clouded; by which circumstance, and the continual interchanges of the sea and land breezes, the heat of the air is moderated, and its stagnation in a great measure prevented. The distempers are the *cholera*, flux, and a continued putrid fever. This last comes on suddenly with a *delirium*, and is attended with constant watchfulness, a vomiting of bile of various colours, but chiefly green. The extremities grow cold, whilst the inward parts burn, and the thirst is excessive; but the fever comes soon to a *crisis*. The evacuation of the first passages is the principal part of the cure; and next to that, the author recommends saffron,* a powerful antiseptic as well as a cordial medicine.†

The British settlements on the Gold-coast, in Guinea, are as near the line on one side as Java is on the other. In that country, the rainy season begins about the end of April and continues till past the middle of

been told by a gentleman, who made the experiment in Jamaica, that though iron rusts very soon in that island, yet that salt of tartar seemed to attract moisture from the air more slowly there than in Britian. I imagine therefore that the speedy rusting of metals, in hot climates, near the ocean, is owing to the great exhalation of the spirit of salt, which flies off from the sea-water by means of the heat.

(100) The fever of Batavia is derived from the same causes as the yellow fever, in the United States and the plague in Egypt. The trifling difference in their symptoms is produced wholly by a difference of climate.

* Bont. Method. Medend. cap. xiv.

† Append. Paper. ii. exp. xi. Pap. iii. exp. xvi.

June; from that time the weather is cold for the climate, and the air very moist, from the exhalation of so much rain. During this cold season remitting, and intermitting fevers with quotidian paroxysms are epidemic. These fevers are accompanied with great thirst, with a *nausea* and inquietude, and frequently with a vomiting and purging of putrid bile; nor do they usually abate till that is evacuated. If a discharge of that humour is not made in time, the distemper assumes a continued and malignant form, the pulse sinks, and a *delirium* comes on, which is generally fatal. Fluxes are likewise frequent at this season; and both fever and flux are not less common on board the ships lying off the coast, than on shore, but do not affect such as keep out at sea beyond the limits of the foggy air. The sea and land breezes here, with the haziness of the weather during the hot season, seem to be of the same use as at Java for preventing pestilential diseases.*

Nor do the bilious fevers of the West-Indies, though of a putrid nature, ever turn to a plague; because the same kind of breezes prevailing there, may prevent that degree of stagnation and corruption of the air which is necessary to produce it. But the heats being great, and the atmosphere loaded with vapours, fevers of remitting and intermitting forms, with bilious vomitings, become epidemic throughout June, July and August (April and May are always rainy months in Jamaica) and rage most after the wettest seasons. These fevers are incident to the natives as well as to strangers. But the new comers are liable to a more putrid and a more dangerous fever, or rather to a

* This account of Guinea, I had from persons of observation who had lived some years in that country.

higher degree of this bilious disorder, which, though not confined to any certain time of the year, mostly coincides with the former. This last is distinguished by vomitings of matter, sometimes green or yellow, at other times black and bloody, but chiefly by the yellowness of the skin, which gives it the name of the *yellow-fever*. The blood is so much resolved, that before death it enters the smallest vessels and tinges the *saliva*, and the *serum* discharged by a blister.*

* Dr. Warren (in his treatise concerning the malignant fever in Barbadoes) mentions several other symptoms indicating putrefaction of the humours, and nervous spasms consequent thereupon. This ingenious author appears however to have mistaken the nature of the yellow-fever, by referring it to the pestilential class of diseases: but though he died young, we are informed that he was sensible of his error, and had he lived longer, would have corrected it. By Dr. Hillary's account, we can see a similarity in the symptoms, and in the treatment, with the bilious fevers of other hot climates. But, upon this article I received the most satisfaction from Dr. Huck, who having been upon the expeditions to the French and Spanish islands, in the late war, made the following remark upon the paragraph above: "Even in the most ardent and worst kinds of the yellow-fever, I think a paroxysm may generally be perceived once in four and twenty hours; for the patient is commonly worse towards the evening, or at night. And if the yellow-fever was to be distinguished, in its beginning, from the common remitting or intermitting fever which was so fatal to our army, it was only by all the symptoms running higher, and by a greater degree of the fever when one might have expected freer remissions. Both fevers began with nearly the same symptoms; sometimes, though rarely, with a shivering. But whenever the fever ran high with burning heat, violent pains of the head and loins, profuse sweats without relief, redness and burning pains of the eyes, inflamed countenance, watchfulness, anxiety, oppression, and burning pains about the *præcordia*, frequent vomitings of green or yellow bile, or (what I think was rather worse) a constant retching to vomit without bringing up any thing, or vomiting the drinks only, one might then almost certainly fore-

The result of the whole is: Wherever the greatest causes of putrefaction exist, there also will be seen the greatest number of remitting, intermitting, or bilious and putrid fevers.

Before I conclude, it may be proper to take notice, that we have also fevers of a bilious kind in Britain; and that both our remitting and intermitting fevers, and dysenteries, seem no less owing to a putrid cause than those of other countries. But I must add, that such is the dryness of the soil, and its freedom from marshes, the constant perfusion and the moderate and interrupted heats of our summers, that unless in extraordinary hot and close seasons, and in marshy places, these distempers are mild, and scarce ever epidemic.

In fine, during the latter part of summer, or through-

“tel the yellowness; and if this appeared on the second, third, or fourth day, the disease was generally mortal. I have often seen patients labouring under most of these symptoms immediately relieved by early evacuations, and the fever brought to intermit. Nay, I have more than once seen this fever with all these symptoms carried off by bleeding and exhibiting, within a few hours from the first attack of the disease, a medicine which operated pretty briskly both by vomit and stool; and I have known some of these very patients, who were so well as to go abroad on the second or third day after, and who continued well for four or five days, but on committing some error, such as exposing themselves too much to the sun, were again seized with the same symptoms, and died on the fourth or fifth day, with their skin tinged of a deep yellow or copper-colour. Hence I am apt to think that these are different degrees of the same disease, and that it sometimes depends upon the manner in which the patient is treated in the beginning, whether he shall have the yellow, or only a remitting or intermitting fever.”(101)

(101) There can be no doubt of the truth of this opinion quoted from Dr. Huck, a physician whose talents for observation and discrimination were well known to the editor.

out autumn, there seems to be in most places a tendency, more or less, to these remitting, and intermitting fevers, or to some disorders of the first passages, connected with a resolution of both the fluid and fibrous parts of the body. And this holds chiefly in hot and moist countries, and in all camps, for the reasons already given.*

SECTION V.

Of the Cure of the Remitting and Intermitting Fevers of the camp, and of those of low and marshy countries.

I COME now to the cure, in treating of which I shall observe the following method. In the first place I shall distinguish the two sorts of fevers as before, and then I shall mention such remedies as I have found most successful in them.

The cure of the camp-fever depends chiefly upon evacuations and a low diet; neutral salts and diluting acid liquors† are assistants; and the bark is useful when there are complete intermissions.

I found it necessary to begin with opening a vein, and to repeat the bleeding according to the urgency of the symptoms. The vernal and latter autumnal remitting fevers are accompanied with pleuritic and rheumatic pains, from the coldness of the weather, and on that account require more bleeding. A person unacquainted with the nature of this disorder, and attending chiefly to the paroxysms and remissions, would be apt to omit this evacuation, and to give the bark prematurely; which might bring on a continued

* Part i. ch. i. Part ii. ch. ii. § 2.

† The barley-water was acidulated with a little vinegar; and in the convalescent state we assisted the bark with the elixir of vitriol.

inflammatory fever. A vein may be safely opened either during the remission, or in the height of a paroxysm. For, besides that I have observed the remission to come sooner and fuller after an hæmorrhage, I have repeated experience of the safety of bleeding in the hot fits; and not only in this, but in the marsh-fever, even after it had come to almost regular intermissions. In order therefore to make Celsus's maxim† consistent with this practice, we must interpret his term *impetus febris* in the sense of that chilliness or cold fit which preceded the hot one in the fevers which he describes; for then bleeding would indeed be improper. But as the paroxysms of our fever, after the first attack, were without any coldness, his caution was not to be minded; nor any other except the common one, of not bleeding during the sweat.

Since the first two editions of this work, having had more opportunities of seeing these fevers, I found it the best course to give a purge, at any time of the day, immediately after bleeding, and the rather as the patient was then generally costive:

℞ *Infusi senæ communis* ℥iii. *electarii lenitivi* ℥β. *nitri puri* ℥i.
tincturæ senæ ℥vi. *misce.*

The half only was taken at once, and if it did not move him twice in four hours, which generally it did not, he then took the remainder. This potion agreed with the stomach, purged plentifully and with ease, and therefore was a more useful than elegant composition. Next morning (when there was almost always a remission) I gave one grain of tartar emetic, rubbed to a powder with 12 grains of crabs-eyes, and re-

† Quod si vehemens febris urget, in ipso impetu ejus sanguinem mittere, hominem jugulare est. *Lib. ii. cap. x.*

peated the dose in two hours, if the first had little or no effect; at any rate in four hours. This medicine not only vomitted, but generally opened the body and raised a sweat. By these evacuations, the fever generally became easier, and was sometimes quite removed. Some of the regimental surgeons had made the first trials with the small doses of the emetic tartar; but having seen the operation, as they gave it with diaphoretic antimony, prove too rough, I changed that part of the composition for the crabs-eyes. Formerly, instead of this powder, I gave in the first remission after seeing the patient, a scruple of ipecacuanha with two grains of emetic tartar in one dose. But though this often succeeded, yet upon comparison I preferred the method above mentioned, *viz.* first purging, and then clearing the *primæ viæ* with small doses of the antimonial preparation. This medicine I usually repeated next day, or the day following; if not, I opened the body with some mild laxative or a clyster, and continued this method till the fever went gradually off, or intermitted.

I have been since confirmed in my good opinion of this practice, by the account which Dr. Huck gave me of his success in such fevers, both in North-America and the West-Indies, by a method similar to mine. In the beginning, he let blood; and in the first remission, gave four or five grains of ipecacuanha, with from half a grain to two grains of emetic tartar: this powder he repeated in two hours, taking care that the patient should not drink before the second dose; for then the medicine more readily passed into the bowels before it operated by vomiting. If after two hours more, the operation either way was small, he gave a third dose, which commonly had a good effect in car-

rying off the bile; and then the fever either went quite off, or intermitted so far as to yield to the bark. On the continent, he found little difficulty after the intermission; but in the West-Indies, unless he gave the bark upon the first intermission, though imperfect, the fever was apt to assume a continued and dangerous form. Dr. Huck never varied this method, except from a stronger indication to purge than to vomit; in which case, he made an eight-ounce decoction, with half an ounce of tamarinds, two ounces of manna, and two grains of emetic tartar; and dividing this into four parts, he gave one every hour till the medicine operated by stool.*

As I did not begin to use the emetic tartar, in small and repeated doses, till the late war (and then only during three encampments in England) I had in those easy campaigns too few opportunities of trying this practice, so as fully to satisfy me that it was the best; but partly from what I saw myself, and heard from the regimental surgeons, I imagined it was most likely to succeed, even before Dr. Huck communicated

* Since the last edition of this work, Dr. Huck told me, “That in the highly bilious or yellow-fever of the West-Indies (where the stronger vomits, if not administered very early in the disease, are thought to be hurtful, but where nevertheless it seems necessary to clear the *primæ viæ*) he preferred this medicine. For, that though the first or second dose of it generally excited some degree of vomiting, yet in three or four hours it also purged; and that this last operation he endeavoured to keep up, by giving from time to time two or three spoonfuls more, until an evident remission appeared, which was usually on the fourth or fifth day from the beginning of this disease. That he watched attentively for this remission, and upon its first appearance began to give a decoction of the bark, in as large and as frequently repeated doses as the stomach could bear.”

his observations. I have been informed since, that in other countries, in such fevers, the chief medicine after bleeding is this antimonial preparation, given from a quarter to half a grain, three or four times a day, throughout the disease; in which dose it is not intended to puke, but to evacuate the bile by stool, and which it does with more certainty when assisted by clysters.

The neutral salts were given after the evacuations, in order to bring the fever sooner to a crisis, or to regular intermissions. The saline draughts made with lemon-juice being too costly for common hospital-practice, instead of that acid, we saturated the salt with the spirit of vitriol; but since that time, for the same intention, I have preferred the *elixir vitrioli acidum*, as in this *formula*:

℞ *Salis absinthii* ℥i. *elixiris vitrioli acidi* ℥ij. *vel quod satis sit ad saturationem, aquæ puræ* ℥vi. *aquæ cinnamomi simplicis* ℥i. *syrupi e corticibus aurantium* ℥℞. *misce.*
Dentur quinquies vel sexies die cochlearia iv.

I come next to the bark, and shall observe, that these fevers have often such fair remissions, and even with a breaking in the water, as might persuade a physician unacquainted with their nature, that they would always yield to that medicine; but he would be often disappointed.(102) Whether it be that some inflammation hinders the bark from taking effect, or that these quotidians are not true intermittents (as not being of a tertian or quartan form) certain it is, that they

(102) In the bilious remittents of the United States, of the first, second, and sometimes of the third grade, the bark is equally ineffectual in curing them. Indeed it is generally offensive to the stomach.

can be seldom safely stopped by it. For, though the paroxysms have disappeared under its use, yet having so often seen the breast affected, or a lurking fever remain after giving the febrifuge, at last I made it a rule to attempt the cure without it; or at least to delay giving any, till in the convalescent state the patient required it only as a strengthener. And indeed there seems to be the less occasion for the bark here, as by bleeding once or twice, clearing the *primæ viæ* by the purge and the emetic, and afterwards by keeping the body open, the paroxysms commonly lessen daily till they quite disappear. But whenever I found that the distemper was not likely to take that turn, but that in spite of the evacuations, the fits became worse (which was often the case in the marsh-fever) I then had recourse to the bark; and when it was most wanted, I have generally had the satisfaction of seeing it most effectual. As the intervals between the end of the sweats and the beginning of the subsequent paroxysms were very short, in order to have the more time to give the bark, I began to administer it two or three hours before the sweat ended. In general, we may consider the feverish paroxysm as over, when the thirst and heat have ceased, and the patient finds himself in a profuse and easy sweat. But if ever the fever appeared in a tertian or quartan form, after the usual evacuations the bark was a sure remedy.

The bark answered best in substance with Rhenish wine, after standing a night in infusion; but for common use it was made into an electuary, in which, to each ounce of the powder a drachm of *sal ammoniacus* was sometimes added.

This was the practice in the beginning of the fever, and also in its remitting and intermitting state. But if the disease was neglected in the first stage, or if after

remissions or intermissions it changed into a continued fever, a vein was opened, if the pulse could bear it; but at any rate, if the head was affected with pain or *delirium*, leeches were applied to the temples, and a large blister was laid between the shoulders. At this time, neither strong vomits nor cathartics were given; but gentle pukes, repeated clysters, or some lenient purges were administered: the chief rule to be observed was to clear the *primæ viæ*.

But though a sweat was then the proper crisis, we abstained from the *serpentaria*, volatiles, and other warm medicines, unless when the pulse sunk, and the *petechiæ* or the like bad symptoms appeared; in which case it was necessary to use some of the warmer alexipharmacs, and to treat the disease like, what it was in effect, a malignant fever.*

Sometimes the fever changed into a dysentery, which was treated in the manner directed in the following chapter. But if a *diarrhœa* came on, though that was never to be stopped suddenly, yet it was often found proper to restrain it gradually, and to promote a *diaphoresis*.† Although a looseness was not the

* Chap. vii.

† If the first passages have not been sufficiently cleared in the beginning, and the body kept open during the course of the fever, we can expect no other crisis than by a looseness; which therefore is not to be stopped as long as there is strength to bear it. But if there has been no omission at first, with regard to the evacuations by emetics and cathartics, or if the patient is too much weakened by the flux, after some rhubarb, let him take twice a day the following bolus:

R *Theriaca Andromachi* ℞i. *radicis ipecacuanhæ in pulverem contritæ* gr. ii. *vel* iii. *cretæ preparatæ quantum satis est: misce.*

This medicine, with the proportion of the ingredients varied occasionally, I have known effectual in checking the purging, and

common crisis, yet if nature pointed that way (by cholic-pains, or a tension of the belly, attended with a dryness of the skin) it was necessary to procure frequent stools by clysters, or some mild laxative (such as an infusion of rhubarb with manna) repeated as often as the patient could bear the evacuation.

II. The camp and marsh-fevers are not more alike in their symptoms than in their cure. The rules therefore laid down in the preceding paragraphs being applicable to both, I shall only offer a few cautions concerning those points wherein they seem most to differ. When the fever of the marshes is of an ardent kind, it may seem to require large bleeding; but in general as the humours have here a more putrid tendency than common, this disease admits of less bleeding than the camp fever, in which, by great and frequent colds, the blood becomes more inflamed. However, in most cases it was necessary to open a vein, either upon the first attack, or the next day, if there was no intermission. But repeated bleedings, unless upon evident marks of a fixed inflammation, were so far from producing the desired effect, that they seemed to render the fever more obstinate. It ought also to be remarked, that the rule about bleeding regards the soldiers only, and not the natives, whose constitutions were different from those of our men, who were not

bringing a salutary moisture upon the skin. But when the looseness could not be moderated by it, I then ordered the following mixture:

℞ *Extracti Thebaici grana ii. solvantur in julepsi e creta* ℥xvi.
Dentur post alternas sedes liquidas cochlearia iv.

This is my common astringent mixture, which, upon comparison, I have observed to be fully as efficacious as that with the *electarium e scordio*, and more agreeable to the taste and the stomach.

only young, but robust and sanguine. And even amongst the soldiers, bleeding was seldom necessary upon a relapse, or after the weather grew cool; as the fever then appeared without inflammation, and as a regular intermittent.

I observed, that vomits were still more efficacious in the marshes than in the camp; in so much, that when a large quantity of bile was evacuated by an emetic, the fever would often be removed at once. But this was not to be obtained by the ipecacuanha alone, which I have seen have a contrary effect, in making the subsequent paroxysms longer and more violent than the preceding; whether that was by acting weakly, and sending more of the corrupted humours into the blood than it discharged from the *primæ viæ*, or from some other cause, is uncertain:* for this reason I added two grains of the emetic tartar. (103)

The marsh-fever, during the hot season, being more apt to run into double paroxysms, or to change into a continued form, than to remain regularly intermittent, it was necessary, after due preparation, to stop it in the first fair intermission. And for this purpose the bark was found to be no less specific in those parts than at home. But I must add, that though large quantities were given, relapses were not only frequent but certain, if the medicine was not repeated more frequently than the soldiers could generally be prevailed

* I had twice experience of this effect of the ipecacuanha by itself in my own case.

(103) It is a common objection to many remedies, that they are worse than the disease they are given to cure. It is necessary this should be the case in order to their producing a salutary effect. The emetic tartar succeeded better than ipecacuanha in this fever, only because its stimulus transcended the force of the disease, and thus induced a new and healthy action in the system.

upon to take it: so that upon the whole, the bark was less useful than might have been expected. But observe, that no bad consequence arose from repeating it often. For, the visceral obstructions, which succeeded to these fevers, were not to be imputed to that medicine, but to a long continuance of the disease, or to frequent relapses; against which there was no security, unless the patient took an ounce of the powder once every ten or twelve days, throughout the autumn. The most effectual way to make a soldier continue the use of the bark, is to mix it with equal parts of brandy and water.* (104)

The next means of prevention depend on a proper diet. The convalescents must eat moderately, especially of greens and of fruit, and are to abstain from new small-beer, and whatever is flatulent or tends to relax. In general, whatever produces such effects disposes the stomach to indigestions, and thereby to a corruption of the humours; and, on the other hand, whatever braces proves antiseptic. A moderate use of spirits is at this time necessary; but as a soldier's pay is insufficient for providing both wholesome food and strong liquor, the public should make, on such occasions, an allowance of spirits to the army, as it does to the navy, though perhaps half that quantity might be sufficient.

For the round worms, which so often accompany

* I have since observed, that the surest way of preventing a relapse in those who unwillingly return to the use of the bark, is to give four or five ounces in powder, as fast as the patient can be prevailed upon to take it: this quantity he may finish in six or seven days.

(104) The French physicians found a watery infusion of roasted and ground coffee with the bark to be agreeable to the soldiers in the fevers of Egypt. The less patients are accustomed to spiritous medicines, or to the use of medicines in spirits the better.

these fevers, I commonly gave half a drachm of rhubarb, with twelve grains of calomel, without observing any inconvenience from so large a dose of mercury, which with us was always duly prepared. Such anthelmintics as act slowly, and do not purge, seemed to have little chance for doing service here, as the symptoms were generally so urgent as to require some quicker remedy. For, though these animals will sometimes lie long in the bowels, without creating much uneasiness to a person otherwise well, yet in a fever, especially one of a putrid kind, the worms being annoyed by the increase of the heat, and the corruption of the humours in the *primæ viæ* (consequent on the fever) begin to move about and struggle to get out. Lancisius, who makes this remark, adds, that some of the bodies being opened of those who (at Rome) had died of such a bilious fever, they found wounds in the intestines made by the biting of the worms: nay, that some of them had even pierced through the coats of the guts, and lay in the cavity of the *abdomen*. In our hospitals, no dissection of that kind was made, but I have known many cases in which the worms escaped by the patient's mouth, though there had been no previous retching to bring them up. But, without advancing so far, they will occasion some very alarming symptoms. I remember, a soldier was brought to the hospital, about the end of summer, ill of one of these fevers, but with more than usual disorder in his stomach and bowels, not yielding to the common evacuations; the muscles of his face were strangely convulsed, and he was so restless that he could not lie for a minute in the same posture. At first I did not suspect worms, but in a day or two after, the patient having voided a round one by stool, I then gave him the powder above mentioned, which

either upon the first or second dose, brought away several more: after this, the extraordinary symptoms ceased, and he soon got well.

I shall conclude this subject with an extract of a letter which I received from Dr. de Monchy of Rotterdam, who, during the time of my service, was physician to the Dutch troops which then made part of the allied army. This gentleman, after perusing one of the former editions of this work, favoured me with some remarks upon it; and among others, with what follows, upon the bilious fevers. This was the more acceptable, as my learned friend had not only had the same opportunities with me of seeing these distempers in the camp, but also in his private practice, both before and since the war, in his own country, where they are more numerous and of a worse kind than in Britain. These are his words:

Sic ceteræ observationes meæ a tuis parum vel nihil differunt, nisi forte quod venam secandi (raro saltem) non tantam in febribus biliosis necessitatem invenerim; imo naturam imitando, præcedente emetico, subinde vomitum excitando (prout magis minusve ad superiora materia turgeret) et levem, sed per dies aliquot protractam diarrhœam eccoproticis efficiendo, feliciter, sine ulla alia notabili critica evacuatione, centenos curaverim; et adhuc quotannis, tempore autumnali, optimo cum successu et brevi curem.

Quoad tempus vomitorio utendi Boerhaavium aliosque practicos secutus sum, dando illud tribus vel quatuor horis ante paroxysmum, in ea continuo permanens opinione, quod major tunc sit materiæ morbosæ accumulatio et activitas; et postea major subactio, et facilior per urinam evacuatio. Simplex hæc fuit mea semper methodus curandi febres biliosas cum oris amaritie, nau-

sea, vomitu, &c. dum ægri adhuc in primo initio morbi versabantur.

Quantocyus in continuis, vel parum tantum remittentibus, æque tempore vespertino quam matutino præscribebam vomitorium ex pulveris ipecacuanhæ scrupulis ij, et tartari emetici granis ij; et statim hora post hujus remedii finitam operationem, ut purgans, cremorem tartari ad unciam i. ex lacte ebutyrato assumerent ægri sedulo curabam. Hæc postero die, si eadem fomitis adessent signa in primis viis, imo et tertio die iterabam. Si vero febrem, ut et pleraque ejus symptomata immutata videbam, alvum tantum laxam servare conabar simplici decocto hordei et tamarindorum cum nitro.

CHAPTER V.

Observations on the Obstructions consequent on the Remitting, and Intermitting Fevers of the camp, and those of marshy countries.

A LONG continuance of these fevers, or frequent relapses into them, brought on visceral obstructions ending in a dropsy, or a jaundice.

The dropsies seemed to be chiefly owing to obstructions of the liver and spleen, in which case the watery swelling generally began at the feet and rose gradually to the belly.

But when the belly alone was swelled, and that suddenly, after the unseasonable use of opiates in the dysentery, or of the bark in intermittents, the *colon* then became distended with air, and the distemper was a true *tympanites*. Such cases indeed did not often occur; but when they did, they yielded to the following remedies. If there was any degree of fever, I began with bleeding, and gave the common saline mixture,* with rhubarb; but if there was no fever, a few grains of the *species aromaticæ* were joined to the laxative; and the patient drank some strong camomile tea. Every night at bed-time, till the tumour disappeared, I gave fifteen grains of rhubarb, or as much as was sufficient to procure one or two stools the next day. When the swelling gave way, if the pulse was slow, and if there was no thirst, without omitting the rhubarb, I endeavoured to strengthen the bowels, by an electuary of camomile flowers and ginger, with a small proportion of steel.

* See page 182.

All strong purging medicines, and carminatives without laxatives were hurtful.

A man who had been some weeks ill of this distemper and was feverish, died suddenly in the night time, upon his belly subsiding all at once, after three or four loose stools occasioned by taking some squills. The body being opened, neither air nor water were found in the cavity of the *abdomen*; but the *colon* was so large and relaxed, that it seemed to have contained air enough to have been the cause of the tumour. This case suggested the use of a swathe in such disorders; as the patient may thereby always make a compression suitable to the decrease of the air in his bowels.

The *ascites* comes on more slowly, and is generally attended with anasarcaous swellings, and a paucity and thickness of urine. Sometimes the intermittent goes off when the swelling begins; at other times it continues, or comes and goes in an irregular manner. I observed that these dropsies were not to be cured by purging alone, nor by soap, nor mercurials; but chiefly by the lixivial salts, either in the form of broom-ashes, salt of wormwood, or salt of tartar. The common method was this: about forty grains of salt of wormwood (or of tartar) were dissolved in about ten ounces of an infusion of the *absinthium vulgare*, to which were added about two ounces of the spirit called Holland-Gin; and this mixture was taken at three draughts and repeated daily. The patient had no other medicine, except, once in four or five days, half a dram of *pilulæ ex colocynthide cum aloë* for a purge; and in the decline of the disease, some common chalybeate. Sometimes the *diuresis* was promoted by swal-

lowing garlic, (105) or mustard-seed. Although the *ascites* was accompanied with the hard swelling formerly mentioned,* nothing was further done, except fomenting the part, or covering it with a warm plaster. Some irregular and obstinate agues were removed by the same medicines; or if they returned after the cure of the dropsy, they were then successfully treated with the bark. †

The jaundice, without fever, was likewise cured by the lixivial salts, and the same purge; and both in that distemper and in the dropsy, I have observed good effects from antimonial vomits.

(105) Dr. Sydenham mentions cures of dropsy being performed by the use of garlic.

* Part iii. ch. iv. § 2.

† Since that time, I have given in cases of irregular agues, where I suspected obstructions of the *viscera*, the following mixture (little different from that mentioned above) for a continuance, and with good effects:

℞ *Florum chamæmeli* ℥β. *aquæ puræ bullientis* ℥viii. *macera per dimidium horæ et colaturæ admisce spiritus vini Gallici* ℥ii. *salis absinthii* ℥i.

Dentur quater, quotidie, cochlearia iv.

CHAPTER VI.

Observations on the Camp-dysentery.

THE bilious disorders of the camp were divided into fevers and fluxes; * and therefore as I have fully treated of the former, I shall now come to the latter, but confine myself to that species called the *dysentery*, as it is the least known out of the field, and is often general and fatal there. I shall first describe the disease; then give an account of the dissections of some who died of it; after which, I shall inquire into its cause; and lastly, propose what I have observed to be most successful in the cure.

SECTION I.

A Description of the Camp-dysentery.

SOME dysenteries appear upon first taking the field; but the cases are never so bad, nor nearly so frequent as towards the end of summer, or in the beginning of autumn. At that time they become epidemic and contagious, prevail for about six weeks or two months, and then cease. (106) They are always most numerous and worst after hot and close summers, especially in fixed camps, or when the men lie wet after a march in warm weather.

The diagnostics of the dysentery, besides some feverish symptoms, are a disorder at the stomach and wind in the bowels, small, but frequent stools of a

* Part ii. ch. i.

(106) The contagiousness of dysentery is denied by nearly all thinking physicians. When epidemic, it spreads like the yellow fever, only from an impure atmosphere.

slimy and frothy matter, a *tenesmus*, and gripes. Blood mixed with the *fæces* is a common, but not a constant symptom; for, many have all the other marks without this, at least in the beginning, and others have blood in their stools from various causes without a dysentery: but as this disorder is mostly attended with blood, for that reason it has been called the *bloody flux*.

These may be called the pathognomonic symptoms, and as such may distinguish this illness from a *diarrhœa*, an hemorrhoidal, and all other fluxes. Agreeably to this description, Sydenham and Willis use the term *dysentery*, and apply it to every case of that flux which raged at London in the year 1670; though Sydenham says, that some of his patients voided no blood; * and Willis observes, that those whom he attended, for the most part, had none but watery stools: † the name is one of the few particulars in which those celebrated authors agree in their account of that disease. The learned Morgagni mentioning that epidemic, takes notice of the propriety with which Willis applies the word *dysenteria* to a flux with the symptoms above-mentioned, though without blood, but adds, that, for the more distinctness, he would call such the *dysenteria incruenta*. ‡

It may be remarked, that, in confining this appellation to such symptoms, I have departed from the ancients, and for that reason may be the more blameable, as, upon a former occasion, I found fault with others for the like freedom. § But in the case of the *ileus*, which I allude to, Sydenham had made an unnecessary change, by giving different names to two

* Morb. Acut. sec. iv. cap. iii.

† Pharm. Rat. sec. iii. cap. iii.

‡ De Sed. et Caus. Morb. epist. xxxi. § 11 et 13.

§ See part iii. ch. ii. § 6.

stages of the same disease; whilst here, the ancients having used a term, either in so lax a sense, as to include several ailments of a different nature, or, in so confined a sense, as not to comprehend all the varieties of the same distemper, I was forced to leave them, and take the definition from those who seem to have treated these disorders of the bowels with more precision.

Thus, the word *dysentery*, in the original Greek, importing *a disorder of the bowels* in general, we find Hippocrates using it, not only to signify all ulcerations, but all hemorrhages of the intestines (even those which are critical and salutary) and likewise every kind of flux, with, or without blood.* It would seem however, that after his time some of the other Greek authors, whose works are lost, were sensible of this want of precision, and therefore restricted the meaning of the term to an ulceration of the bowels, attended with gripes and *tenesmus*, and with mucous and bloody stools. For a disease with these symptoms Celsus calls *tormina*, and says, it is the *δυσεντερία* of the Greeks;† and Cælius Aurelianus, retaining the Greek name, describes the dysentery much in the same manner with Celsus.‡

Yet Galen returns to the looser acceptation of the

* *Dysenteria est exulceratio intestinorum—Alii vero, inter quos ipse Hippocrates est, dysenteriam interdum appellant non ipsam modo exulcerationem intestinorum, verum omnem etiam cruoris per intestina vacuationem. Gorraeus, in voce Δυσεντερία.*

Ejus etiam dysenterię, quę plerunque morbos plurimos salutariter ac judicatorie solvit, meminisse videtur Hippocrates (Piorrh. 2.) *Δυσεντερίην* etiam pro quovis alvi profluvio capere videtur Hippocrates (lib. ii. Epidem.) Foesii *Oeconom.* Hipp. *in eadem voce.*

† De Med. lib. iv. cap. xv.

‡ De Morb. Chron. lib. iv. cap. vi.

word, sometimes defining a dysentery *an ulceration of the bowels*, at other times mentioning four *species* of that distemper, all with bloody stools; but whereof we find only one agreeing with the *tormina* of Celsus, or the *dysentery* of the moderns.* I have consulted none of the other Greeks upon this article (supposing they followed Galen) excepting Aretæus, who, after Archigenes, confining the term to an ulceration of the bowels, accounts for all the symptoms according to the particular gut affected, and the circumstances of the sore; which if deep, and corroding some large blood-vessel, he supposed might occasion a mortal hemorrhage.†

From this it appears, that the term *dysentery*, as used by Hippocrates and Galen, conveys no precise notion of a disease; and that unless those symptoms, which I have called *pathognomonic*, are always joined to an ulceration of the bowels (which is not always the case) the dysentery of Celsus, of Aretæus, and of Cælius Aurelianus must be accounted a different ailment from that which I am now treating of. Not, but that the bowels are liable to be ulcerated in the true dysentery, but that ulceration is accidental and not essential to the disease. Morgagni in one place observes, that in this distemper the intestines are sometimes affected with ulcers, and sometimes not;‡ and, in another place, he takes notice of the ulceration happening only in its more advanced state.§ Further, from the dissections of that excellent anatomist, compared with those collected by Bonetus, and those made by Mr.

* De Caus. Sympt. lib. iii.—de Loc. Affect. lib. ii.

† De Caus. et Sign. Diut. Morb. lib. ii. cap. ix.

‡ De Sed. et Caus. Morb. ep. xxxi. § 12 et 13.

§ Somewhere in the same epistle.

Cleghorn,* and by myself, there will appear more instances of the soundness of the intestines, in this respect, than the contrary.

This opinion, concerning the constant ulceration of the bowels, continued till Sydenham and Willis considered the dysentery as a disorder independent of any ulcer; and upon their authority, physicians seem now to have relinquished the former system. And indeed Sydenham's account is upon the whole so just, that believing it unnecessary to enter upon a farther enumeration of symptoms, I shall refer the reader to that well known author; confining myself to a few observations, to ascertain some points which he has left doubtful; and adding some others, for rendering the history of the disease more complete.

Sydenham having little inquired into the nature of any dysentery, excepting that which he himself describes, therefore questions whether there may not be as many kinds of that distemper as of the smallpox and other epidemics; which, according to him, so much vary, as in some particulars to require a different treatment.†

That excellent author seems to have been led into this opinion of the varying nature of epidemics, though appearing in the same form, from a belief, that the wisdom of Nature was most manifested in its variety: “ For (says he) we are not to be surprised at these *lusus Naturæ*; since it is universally acknowledged, that “ the deeper we penetrate into the works of Nature, “ the more we shall see of the vast diversity, and the

* Observ. on the Epidem. Diseases of Minorca, ch. v.

† —cum fieri quidem possit, ut variæ enascantur dysenteriarum species, ut sunt variolarum, et epidemicorum aliorum diversis constitutionibus propriæ, et quæ proinde medendi methodum in aliquibus diversam sibi suo jure vendicant. *de Morb. Acut. sect. iv. cap. iii.*

“almost divine contrivance of her operations, which
 “far surpass our comprehension.”—“So that who-
 “ever has undertaken to comprehend all those mat-
 “ters, and to trace the multifarious operations of Na-
 “ture, will find himself disappointed.”*

But does Nature manifest its wisdom more by perplexing mankind, with varying distempers every season; or, by presenting them over and over, to teach us their nature and cure? In the first steps of our inquiry, we meet indeed with great variety and obscurity; but as we penetrate further into Nature, we find so much analogy amongst her works, that we are forced to acknowledge and to revere her simplicity.

In the present case, I can affirm, that all the epidemic dysenteries, which I have seen in the army, have been of the same nature; and I have been assured by Dr. Huck, and by others employed, during the late war, not only in Germany but in America, that this distemper appeared with the same symptoms, and yielded to nearly the same medicines, which were observed to be most successful in the military hospitals before. I may add, that both in Scotland and in this country, whenever I had an opportunity of treating such fluxes in my private practice, I never could see that they required any different method of cure.(107)

* Neque est, cur hos Naturæ lusus hæc in re tantopere demeremur; cum in confesso apud omnes sit, quod quo profundius in quæcunque Naturæ opera penetremus, eo luculentius adfulgeat ingens illa varietas, et divinum pene artificium operationum ejus, quæ captum nostrum longissime superant. Adeo quisquis ille fuerit, qui in se receperit hæc omnia mente adsequi, et multifarias Naturæ operationes *κατα ποδας* indagare, partim magnis ausis excidet. *Ibid.*

(107) This remark does not apply to the dysenteries of the United States. They vary in different years and seasons, so as to require different and sometimes opposite modes of cure. The sameness of the dysenteries in their symptoms, and the success of the

Nor do I find that Degner had reason to consider that flux which he describes, as a species different from others, and distinguishable by its contagious and bilious nature.* For I have never known the dysentery epidemic, unless in summer, or in autumn, when the bile is most liable to be vitiated; nor have I seen any number ill of it, without hearing several complain of sickness at the stomach and vomiting of gall. As to the violence of the symptoms mentioned by that author, I own it exceeds any thing that I have observed, upon the first seizure; but, when a number of men, even with the most favourable cases, have been crowded into the hospitals of the army, the dysentery has then appeared with all the virulence that it did at Nimeguen.

Sydenham observes, “ That, as all epidemics, at their first appearance, seem to be of a more spirituous or subtile nature than in their advanced state, so in the like manner the dysentery proceeded; for the longer it continued, it grew the more humoral. For instance, in the first autumn, *several had no stools at all*;(108) but with respect to the severity of the gripings, the violence of the fever, sudden decay of same remedies in curing them in the British armies in Germany and North America mentioned by our author, were probably owing to the sameness of diet, drinks, and military exercises, producing an artificial uniformity in the constitution of the soldiers that composed their patients.

* Hist. Medic. de Dysent. Bilioso-Contag. cap. i. § 1.

(108) The expression of a dysentery “without stools” is incorrect; but it conveys a just idea of the suffocated state of excitement in the bowels, which prevents their acting upon their contents until that excitement is lessened by means of bleeding or purging. It is not in dysentery alone we observe a want of secretion or excretion from excess of morbid excitement. It takes place in the kidneys, in the liver, in the eyes, and in the gonorrhœa constituting what is called a dry clap. The Editor has called them *dry* diseases.

“ strength, and other symptoms, it much exceeded the “ dysenteries of the following years.”* Here then we seem to have a species of the disease very unlike the common sort. But besides that this remark was never, so far as I know, made by any one before Sydenham, nor has been confirmed by any author since, I must observe, that though we approved of his having considered the dysentery as a disorder in which there might, or might not be blood in the stools, yet we cannot justify him in calling that a dysentery, “ in which there are no “ stools at all.”

But if there is any mistake here, it is of little consequence; though I cannot say so much of that observation with which Sydenham concludes his subject. He says, “ That though evacuations both by bleeding “ and purging were indispensable before laudanum “ could be administered, in those years in which the “ dysentery was epidemical, yet in any other constitu- “ tion of the air, which has a less tendency to breed “ this disease, these evacuations may safely be omit- “ ted, and the cure completed by a shorter method, “ viz. by laudanum alone.”† In this, I say, I must declare my dissent; for though we cannot doubt, upon Sydenham’s authority, that some slight cases of the dysentery have been cured by laudanum alone, yet I have seen such bad effects from this practice, both in

* Vid. loc. cit.

†—quod tametsi in his annis, quibus dysenterix adeo epidemice grassarentur, evacuationes prius memoratæ prorsus necessariae erant, antequam ad usum laudani deventum fuisset; attamen in constitutione quavis huic morbo minus faventi, istæ tuto omitti possunt, ac curatio compendiosiori via, solo nempe usu laudani, absolvi eo, quem diximus modo. *Loc. cit.*

the army and elsewhere, that I shall never venture to treat any dysenteric case with laudanum, before the first passages be cleared.(109)

The dysentery, as Sydenham observes, sometimes begins with a *rigor* succeeded by heat, but oftener with gripes without any feverish sensation. This last part is perhaps not strictly true; for though the patient himself may not mention any feverish symptom, yet upon examination we shall find, that alternate sensations of heat and cold, lassitude, loss of appetite, and the like febrile affections have generally been, more or less, the forerunners of the disease. Frequently, the beginning of a flux will have the appearance of a bilious fever; for the patient will have a fever, with a disorder in his stomach and bowels, for two or three days before the purging comes on; but after that, the feverish symptoms sensibly give way. At other times, upon fatigue and exposition to cold, during the dysenteric season, the men will be more suddenly seized with the flux, but rarely without some degree of fever. The sensible diminution of the fever upon the appearance of the looseness, seems to justify that expression of Sydenham, when he calls the dy-

(109) A dysentery prevailed in Keil in Holstein in the year 1794, which yielded only to bark. All evacuations were hurtful in it. A similar dysentery prevailed a few years ago at Darby in Pennsylvania, in which bark was given with uniform success by Dr. Gardiner, without any previous evacuations. These facts are opposed to the practice of our author, and are in favour of the exclusive use of laudanum in the cure of dysentery by Dr. Sydenham. The system, not only in dysentery, but in malignant fevers, is sometimes so suddenly and completely prostrated, as not to react after the use of depleting remedies. In these cases, life can be saved, only by the exhibition of the most powerful stimulants.

sentery, " the fever of the season turned in upon the " bowels " *

Besides this previous fever, the patient is liable to one of a low and more dangerous kind. For the most part I have observed this to be brought on by neglecting the case in the beginning, or by having recourse to opiates and other astringents before evacuations. Sometimes, though seldom, I have seen the same kind of fever accompany the flux from the first, and end in death, without discovering any error committed either in the regimen or medicine. But the most fatal sort of fever, which so often attends the dysentery of the army, though not essential to it, is the hospital or jail-distemper, which at all times infects foul and crowded wards, but never so much as when they contain men labouring under a putrid disease. This fever combined with the bloody-flux is commonly mortal.(110)

The stools at first are commonly copious and excrementitious, but the next day, or soon after, they become small, watery and slimy, and are attended with gripes and *tenesmus*. From this time till the favourable turn, formed *fæces* are never seen, except when a purge operates briskly and carries them down; then indeed the patient is less griped, has fewer motions, and less *tenesmus*.

Besides the *mucus* in the stools, Sydenham ought to have mentioned a watery humour which is generally mixed with the slime. This *serum* is perhaps one cause of the irritation, and descends from the higher

* Loc. cit.

(110) This mixture of the hospital or jail-fever and dysentery sometimes takes place on board crowded ships. It prevailed with great mortality in the town of Derry while it was besieged by James II.

parts of the intestines, whilst the *mucus* is mostly secreted from the *rectum* in straining.(111)

Streaks of blood denote the opening of some small vessels at the end of the *rectum*, but a more intimate mixture is a sign that the blood comes from a higher source. This hemorrhage, which alarms most, is the symptom least to be dreaded; for though the oozing be constant, the quantity of blood lost, except in a few cases, is inconsiderable. Morgagni observes, that most of the blood may come from the intestines, without any rupture of the blood-vessels, and only by their greater dilatation; and this opinion is most agreeable to what I have seen in dissections.(112)

Nor are we to be alarmed at the loss of so much of the serous humour; for the amount of the whole is not nearly so great as in a common *diarrhœa*. Yet the frequency of the motions has given a false indication for the early use of astringents, whilst, in fact, the passage through the intestines is already so much obstructed, that to restore and preserve it, is the most essential as well as the most difficult part of the cure.

There are some other substances omitted by Sydenham, which are less commonly seen in the stools, *viz.* round worms, balls of hardened excrements, and some smaller bodies of the colour and consistence of suet.

Worms are not to be considered as the cause of the

(111) This watery humour, the Editor believes to be a morbid secretion from the liver. He has called it "Diabetes aquosus intestinalis." The facts upon which this opinion is founded may be seen in Dr. Coxe's Medical Museum for April, May and June, 1810.

(112) Blood appears to be discharged from the lungs, and trachea from the same cause. The dysentery with bloody stools is less alarming than what is called the "dysenteria mucruenta." The bowels are depleted by the effusion of blood from them.

flux, but as concurring with other causes to make it worse. It would seem that in this morbid state of the bowels, by struggling to get out, they increased the irritation. Sometimes I have known them make their way by the mouth.

The balls of hardened *fæces* may come away at any time of the disease, but I have observed them mostly in its advanced state, and when I suspected that purging had been too long neglected. I have commonly seen the *tenesmus* and all other symptoms give way, after they were carried off by a brisk dose of physic. These *scybala* are of so firm a texture, and so round, that they seem to have been formed in the cells of the *colon*, and to have lain there from the beginning; for we can scarce suppose them to have afterwards acquired that figure and consistence during a constant irritation of the intestines, and the low diet which patients then use.

As to the white substances, which I compared to suet, I do not know whether they are the same which Hippocrates calls *σάρκες* (*carunculæ*) but they are plainly described by Aretæus and Cælius Aurelianus, and have since been taken notice of by later writers under the name of *corpora pinguia*, and variously accounted for. Although I had frequently seen them, I had neglected to examine them, till the autumn 1762, when Dr. Huck and I visiting a patient in this city, ill of a dysentery, who voided such substances, we preserved one of them which we viewed at leisure, and were satisfied that the subject of our inquiry was nothing but a bit of cheese; though the patient assured us afterwards, that he had tasted none since the beginning of his illness, which had been then of above a fortnight's standing. Now, whether this cheese had been collected from smaller particles, which had passed

from the stomach to the *colon*, before he was taken ill, or had been since formed of milk, which he had always used (and which might have curdled in his stomach) we could not determine; but we were both convinced, that, in whatever manner this substance was produced, it must have been of the same nature with all those *corpora pinguia* which we had so often seen in this disease.

With regard to the abrasions of the villous coat, and other substances said to have been observed in the stools, I can say nothing, having never seen them; though I do not call in question what has been so often mentioned by others.* The offensiveness, and even the danger of such an inquiry, will serve as some excuse for not carrying it further.

The stools are all along distinguished by a certain smell, different from that of common excrements; it is faint, and not rank at first, but towards the end, when the bowels begin to mortify, the *fætor* is cadaverous and intolerable. At such times they are probably most infectious. I have observed elsewhere, that in a natural state the *fætor stercoreus* is owing to a mixture of putrid matter with an acid, and that by this combination the *fæces* acquire a particular and a stronger smell than they would otherwise have, and are less apt to spread infection.† But in this distemper, it would seem as if the acid, which is generated in the stomach, and in the smaller intestines, were hindered by the

* Hæc sunt rementa ζύσματα dicta Hippocrati, quæ merito damnavit.—Testatur Galenus se multos vidisse et sæpe, quibus, cum morbis gravibus et diuturnis conflictatis, maxima intestinorum pars sic corrumpebatur, ut compluribus in locis tota interior tunica esset destructa, imprimis in morbis dysentericis Van Swiet. *Comment. in Aph. r.* Boerh. § 721.

† Appendix, Paper vii. exp. xliii.

spasms from passing through the larger, and that the *feces* were thereby deprived of their proper corrector.

Among other symptoms omitted by Sydenham, is the flatulence, of which the most obvious source is from the aliment, that in this disorder of the stomach ferments too strongly, and generates both this air and an acid; as appears from the experiments subjoined to this work.* Another source may be from the blood and other humours, which stagnate and putrefy in the larger intestines; for it is well known that all animal and vegetable substances yield much air when resolved by putrefaction. Besides, the mass of blood having acquired a more than natural putrescency, by the absorption of corrupted matter from the intestines, may from that cause be more disposed to part with its air, and to throw it upon the *primæ viæ*. But however this may be, it is evident that the air, which abounds at this time in the first passages, occasions often a sense of oppression, or increases the gripes, according to the place where it is collected (whether in the stomach, or in the smaller, or greater intestines) and in proportion to the spasms which imprison it. I have known more than one case of a *tympanites* (*viz.* an immoderate distension of the *colon* by air) from the premature use of opiates and astringents in the dysentery. Early in the disease, the stools are of a frothy consistence like yeast; but this is only the natural state of the *mucus*, which is mixed with the air when it comes out of the glands. For by M. de Haller's experiments, upon pricking the internal coat of the intestines of a living animal, this kind of frothy matter is expressed from the mouths of all the secretory vessels around the irritated part.†

* Paper v. and vi.

† Opera Minora, p. 394 & seq.

It might be of use to know, what gut is particularly affected when the gripes are most severe. But this we can hardly ascertain, considering how much the intestines are liable to change their place by the peristaltic motion,* how their situation may vary in different persons, and how readily the pain of the *colon* may be confounded with that of the smaller guts, which are surrounded by it. In general, the irritation of the stomach and higher intestines is attended with more sickness than gripes; and therefore when the gripes are most acute without sickness, it is probable that the spasm is lower down. When the pain is about the middle of the belly, we may presume that the spasm is in the smaller intestines; but we cannot be certain, as in some subjects the upper flexure of the *colon* has been found as low as the umbilical region. Pains in the sides, back, and region of the kidneys, may be referred to the *colon*; but if the pains are felt towards the *os sacrum*, we may then suspect that the upper part of the *rectum* is affected. For the pain arising from the irritation of that gut may be referred equally to the back, and to the lower part of the belly; as a stone descending from the ureters is felt both ways, behind as well as before. But when the lower extremity of the *rectum* is irritated, the spasm seems not then to be so much productive of pain, as of a violent *nisus* drawing into consent the muscles of that part, as well as others which act in discharging the *fæces*.

The stools are always preceded by sharp gripings, and succeeded by some respite; but the motions being so frequent the patient can have no considerable ease, unless the spasms be removed by opiates, fomenting the belly, raising a sweat, or by evacuating the acrid

* Opera Minora, p. 301 & seq.

and irritating matter with a purge. Indeed when the bowels begin to mortify, the sick, though restless, complain of little pain or *tenesmus*; nay I have known them quite free from these last symptoms, not only for some hours, but for some days before their end. At such times they have some degree of *delirium*, though I have seen several who were sensible to the last.

It may be remarked, that Sydenham mentions nothing of the *tenesmus* till the patient is in a convalescent state, though that symptom be one of the first which characterise the dysentery. But this is not an omission of our author; for what others understand by a *tenesmus*, and what I meant by that term in enumerating the more inseparable symptoms, Sydenham expresses by *intestinorum depressio cum dolore*, and by *molestissimus viscerum omnium quasi descensus*. As to his observation, “of the intestines being affected “ successively downwards, till at last the disease be “ driven to the *rectum*, where it ends in a *tenesmus*,” strictly speaking it cannot be admitted. For though the *rectum* be generally the last part that recovers, and the *colon* remains longer diseased than the small intestines, yet I have known no such progression as Sydenham describes. From the beginning, the whole intestinal tube seems to be affected, and the *tenesmus* is pretty early as violent as it is ever after in the course of the disease. The obstinacy of the *tenesmus* seems sometimes to be the cause of death; for by the constant irritation, the *rectum* at last mortifies. In those bodies which I have opened, I found the appearances of a gangrene always the greater the nearer it was to the extremity of the *rectum*.

Sydenham observes that the *tenesmus*, remaining at the end of the flux, is not owing to an ulceration of the *rectum*: according to him, “in proportion as the

“ bowels recover their tone, they deposit the remains
 “ of the morbid matter in this gut; which being con-
 “ tinually irritated thereby, discharges at every stool
 “ part of the *mucus* with which the intestines are na-
 “ turally lined.” But does it not seem more natural to
 ascribe this remaining *tenesmus* to the soreness of a
 part, which has been so much inflamed and excoriated
 in the course of the disease, and which by its constant
 irritation is still kept from recovering? Add to this,
 the observation that has been often made, of the *tenes-
 mus* giving way upon the patient’s voiding some
 hardened excrements (such as were mentioned above)
 a frequent cause of that irritation. That the *tenesmus*
 which succeeds the dysentery may be sometimes
 owing to an ulcer, is asserted by Morgagni; but he
 gives only one instance that occurred in his prac-
 tice. (113)

Sydenham neither mentions a *procidencia ani*, nor a
 strangury, though I have known both these accom-
 pany bad cases of the dysentery. The former symptom
 arises from the violent straining; and the latter, from
 the inflammation spreading from the *rectum* to the
 neck of the bladder.

Nor does Sydenham take notice of any contagion
 that attended his epidemic. Willis expressly says,
 that the dysentery, which he describes (and which was
 the same with Sydenham’s) was not infectious. But
 all that we can infer from thence, is, that either the
 distemper, which they saw, was of a milder nature
 than it usually is when it becomes general, or that

(113) A *tenesmus* is commonly induced by one or more of the
 following causes. 1. Hardened excrement, called *syballa*. 2. Acrid
 bile or other humours, irritating the *rectum*. 3. An ulcer; and,
 4. The pressure of contiguous parts.

this circumstance of infection escaped their notice. It is true indeed, that this disorder is not so catching as most others of the contagious kind; but whenever it has been epidemic, I always found it in some degree infectious; especially in military hospitals, and in the houses of the poor, who want the means of cleanliness. (114)

The duration and issue of the dysentery are uncertain; much depending upon medicine, good air, attendance, and the care which the patient takes of himself. If nothing be wanting, and the flux recent, it will be generally cured: but these favourable circumstances occur amongst the officers only. The case is different with the private men; who not only apply late for assistance, but are either exposed to colds in the field, or, which is worse, shut up in the foul air of an hospital.

It is the sign of a bad case, when the first vomit and purge do not relieve; when the hectic fever increases; when the disorder of the stomach is obstinate; when the countenance alters much; when the pulse sinks and intermits; when the patient is restless, without complaining of gripes. In the beginning, a hiccup is little to be dreaded; but in the low and advanced state, if obstinate, it is commonly a sign of a mortification. The disease, when fatal, ends in a prostration of strength, a sore throat, or *aphthæ*, involuntary and cadaverous stools. Sometimes, before the end, when the spasms give way by a putrid resolution, the aliment, as in a lientery, will pass through the intestines with little alteration.

In the most favourable event, those men who have

(114) The contagiousness of the dysentery in those cases, arose from its being combined with the hospital-fever. It is never contagious when it prevails as an epidemic from koinomiasmatic exhalations.

been sent to an hospital, can be of little service for the rest of the campaign; for no ailment is more apt to return upon errors in diet, or expositions to cold. Not that these returns are so much relapses into the true dysentery, as they are *diarrhœas*; but with more of the dysenteric symptoms than are common in the white-flux. For though the original disorder takes a favourable turn, yet the disposition to a looseness continues: as the bowels are too tender to bear the natural *stimulus* of the bile, and other secretions, without being irritated by them.

Such are the observations which I have been enabled to add to Sydenham's, from the frequent opportunities that I have had of seeing the dysentery in all its forms.

SECTION II.

Of the Dissections.

HAVING described the disease, I shall next relate the changes which I have observed in the bodies of those who died of it, and were opened. This is a part of its history in which both Sydenham and Degner have been defective.

1. In autumn 1744, a soldier, who had been ill of the bloody-flux for about three weeks, was sent with some other sick from Tournay to the hospital at Brussels. His pulse was low, his strength wasted, the gripes and *tenesmus* were incessant, and his stools were no longer bloody, but of an ichorous colour; a change which often happens from the corruption of the blood. On the third day after his arrival, the pains abated, his pulse sunk, his extremities grew cold, a slight *delirium* succeeded, and he died on the fourth.

I found the larger intestines of a blackish colour and putrid appearance, the coats preternaturally thick

(the mark of a preceding inflammation) and on the inside ulcerated, especially in the *rectum* and lower part of the *colon*, where the villous coat was either abraded, or changed into a corrupted slimy substance of a greenish cast. The *cæcum* and its *appendix* were less corrupted; and the smaller intestines and stomach were neither mortified, discoloured, nor abraded, but only distended with air. The fat of the *omentum* was greenish; but neither the liver nor spleen seemed to be tainted; only the bile was thick, ropery, and of a dark hue. That part of the *vena cava* which lay on the *vertebræ* of the loins was tender. The lungs adhered a little to the left side, but seemed otherwise sound. In the right ventricle of the heart the blood was clotted, but in the larger vessels it was more fluid and of a blackish colour.

2. About the same time, a soldier of the artillery, after recovering of a *diarrhœa*, was seized with a dysentery, as he said, upon drinking largely of some cold liquor, on a march, whilst he was hot. Three days after, he was brought into the hospital; and besides the common symptoms, he complained of the piles and the gravel. This man could not lie down, but supported himself on his knees and hands, leaning his head forward upon the bolster till his death; which happened three or four days after his admission.

Upon opening the *abdomen*, I found the greatest part of the *omentum* in the left side, under the small intestines, but large and fat. The liver was small and sound; but the gall bladder was of an uncommon size, and full of a dark coloured bile, partly thin, partly curdled. The biliary ducts were clear. The *pancreas* was in a natural state. The spleen, though of a common shape, was of an extraordinary bulk, being little less than the liver, and weighed three pounds eleven

ounces: it seemed otherwise sound, had no indentations; only, upon the side next to the blood-vessels, a small protuberance like the *portæ* of the liver. The kidneys were small and flaccid; but the *pelvis* of both, especially that of the left, was larger than common; and both these and the bladder (which was in a corrupted state) contained some urine, but neither stone nor gravel. The *rectum* was most putrid; and from thence the gangrene seemed to have spread itself to the *colon*, which was mortified, and chiefly at its lower end. The villous coat was partly consumed, and what remained was blackish, tender and easily to be separated. The vascular coat had the appearance of a preparation well injected with red wax. The ligaments, which contract the *colon* and form the cells, were half corrupted, and adhered loosely to the outer coat. Part of the *cæcum* was also mortified; the rest, as well as the smaller intestines, were of a firmer texture, but of an inflamed colour; and both these and the stomach were full of air. It was remarkable, that notwithstanding this diseased state of the bowels, no part of them was ulcerated. The cavity of the *thorax* seemed to be uncommonly small; for the convex part of the diaphragm reached as high as the insertion of the third rib into the *sternum*: the lungs were nevertheless sound. The heart was large, and contained in its right ventricle some coagulated blood of a coriaceous firmness, which did not adhere to the sides, but was entangled with the tendinous fibres of the *valvulæ semilunares*. Both the sinuses were full of blood, partly congealed, partly fluid, and of a blackish colour.

3. In the same season, a foot soldier was sent into the hospital, supposed to be ill of a dropsy. His belly was much distended, but the tumour was greatest above the navel. He complained of a difficulty in

breathing; his ancles were a little swollen, but he made water freely; his cheeks were florid, whilst the rest of his face was pale. By his own account, he had been taken ill of a bloody-flux, about three weeks before, which being suddenly stopped by some drug (I presume by opium) given him in the camp, his belly then began to swell.

This man soon after his admission was seized with an inflammatory fever, of which he recovered, and then took such medicines as were judged proper for curing a *tympanites*; during the course of these, one night a looseness suddenly coming on, his belly subsided all at once, and he died before the morning.

The body was opened about thirty hours after his death; but in that time so much air had been generated anew, that the belly had swelled again, though not so much as before. There was no air, and scarce two spoonfuls of water in the cavity of the *abdomen*; but the intestines were all much inflated, except the *colon*, which, though then flaccid, was large enough to have contained, as it probably did, all the air which at first had made the tumour. The ligaments of this gut were either destroyed, or so relaxed that the divisions of the cells were obliterated; but no part of the intestines seemed either mortified or inflamed. The liver was of an extraordinary bulk, reaching almost to the navel and spleen, and weighing about ten pounds. Its substance was tender, and in the posterior part of it, next to the diaphragm, we discovered a large abscess. The gall-bladder was of a moderate size, and full of a thin dark coloured bile. The lungs were sound. We found little or no water in the *thorax*, but more than usual in the *pericardium*. The heart was small, without any clot, and indeed with scarce a drop of blood in the ventricles.

4. Some time later in the season, a soldier was received into the hospital, about the twentieth day of a hectic fever succeeding a dysentery. His pulse was then low, his tongue parched, his cheeks florid, though his body was wasted. He complained of great weakness, of a pain in his bowels, of a looseness, and of retchings to vomit. In a few days after, he was seized with a hiccup and died.

Although the body was opened the next day, the smell was intolerable. The intestines seemed mortified. The outward coat of the liver was putrid; and in the substance of that *viscus* we found several abscesses containing a purulent, or ichorous matter. The spleen was likewise corrupted; but the kidneys, heart and lungs appeared to be sound.

These dissections were made during the former war, and no opportunity of a further inquiry offered till some years after,* when, after an unusually warm and dry summer, the dysentery was frequent in London.

5. A young woman of 17 years of age was taken ill, in the beginning of October, with some of the more alarming symptoms of this disease. Her pulse sunk, and her strength failed early; the stools were incessant, slimy, watery and bloody; and whenever she was free from gripes she complained of sickness. Nothing gave her relief, and she died on the 11th day. About a fortnight after, the father, who had been much affected, and indisposed since the death of his daughter, was seized with the same distemper. He was then in his 46th year, of a full habit, and had lived freely. Till within three or four years of this illness, he had been subject to frequent returns of a fever; but from that

* Viz. in autumn 1762.

time a tetter breaking out in several parts of his body, he became free from every complaint, excepting the crusts and blotches occasioned by that eruption. The dysentery began with a sickness and heat at his stomach, with gripes, *tenesmus* and a looseness. In a day or two, the stools were frequent, slimy and bloody. I was called early in the disease, and believing that evacuations had not been timely enough made in the daughter's case, I began with taking away a large quantity of blood; but as the patient was not relieved, as his blood was not sily, and as his pulse was never hard nor full, the bleeding was not repeated.

I shall not enter into further particulars, but observe, that though various medicines were tried, such as evacuants, antiseptics, demulcents, and anodynes, none of them were of any sensible benefit, excepting a decoction of snake-root with *theriaca*, which was given him when his pulse began to sink and intermit. He died on the 20th day after I was called; but for some days before his death, I observed his countenance alter, and the hectic fever increase; and though his gripes and *tenesmus* had ceased, yet the motions were more frequent than ever, and more watery and bloody. From the first, he was feverish, restless, and complained of a sickness at his stomach, which was increased by every thing he eat or drank; towards the end he was troubled with a hiccup; he never could retain a clyster; and his stools were extremely offensive. He was sometimes slightly delirious; but it was uncertain whether that symptom arose from his fever, or the opiates. On the day after his death, the body was opened by Mr. Hewson, surgeon and anatomist, Dr. Huck and I being present.

Upon cutting into the *abdomen*, we found the *tunica adiposa* of a considerable thickness, notwithstanding

the long continuance of the disease. The stomach and smaller intestines were inflated, but otherwise in a natural state, except at the extremity of the *ileum* where it joins the *cæcum*; for at that part the coats of the gut were thicker and more tender than they ought to have been; and on the inside we found that glossy colour, which is considered as a mark of inflammation.

But the larger intestines, from the *cæcum*, to the end of the *rectum*, were not distended, and the *rectum* was even more contracted than in a natural state. Their colour, externally, was of a purple black; and this gangrenous appearance increased gradually from the *cæcum* to the extremity of the *rectum*. Upon opening them, we found the coats thickened, the inside as black as the under part of the *coagulum* of blood, and the whole surface more or less covered with a dark coloured bloody slime. In the *rectum* these morbid appearances were worst. The blood did not seem to have come from any ruptured vessel (for it was collected no where in any quantity) but to have gradually oozed through a number of fine pores into the cavity of the intestines. The *fætor* of these parts was exceedingly great.

At first sight the villous coat seemed to have been resolved into the slime above mentioned, yet upon a nearer inspection we thought it more probable, that both in the *cæcum* and *colon* the villous coat, though diseased, was not separated, whatever it might be in the *rectum*, which was too putrid to be minutely examined.

The dissector having cleared away the blood and *mucus* from the inside of the *cæcum* and *colon*, and of the upper part of the *rectum*, made us take notice of certain protuberances of a lighter colour than that of the rest of the surface. They were of a roundish

figure, nearly equal in their height (which was about the twelfth part of an inch) but of an unequal breadth. We all agreed that we had never seen any thing so nearly resemble the smallpox, of a flat sort, at the height of the disease. These eruptions stood as thick on this tract of the intestines, as variolus pustules, when numerous, do upon the skin; but differed from them in this, that as far as we examined them, they were of a firm consistence without any cavity. Mr. Hewson was of opinion that they took their rise from the cellular membrane which lies immediately above the villous coat; for that some days before, having opened another person, who had likewise died of the dysentery, he had found the appearances there much the same as in this subject, and particularly with regard to these tubercles, which he had examined at leisure. He added, that he had preserved a part of the *colon* in spirits, which he would show us some other time. These eruptions were only in the larger intestines; for though we likewise inspected the smaller, we could observe nothing similar to them there.

In the whole intestinal tube we found neither worms, *scybala*, nor any formed feculent matter; though the nurse told us, that on the day before his death, the patient had voided some hard substances of a roundish shape.

The mesentery was loaded with fat of a natural colour and consistence; as was also the *mesocolon*, even to its process belonging to the *rectum*, which of all the intestines was observed to be the most putrid.

The urinary bladder was contracted; that part which lay next the cavity of the abdomen was sound, the other was not examined. I ought to have observed, that the patient could retain his urine to the last, though in the beginning of the disease he had com-

plained of a strangury. The kidneys were not inspected.

The liver was in a sound state, not only as to its outward appearance, but in its substance. The gall-bladder was empty of bile, and contained only a little air. The spleen had no apparent fault. The *pancreas* was of a small size, and somewhat hard; yet it was not scirrhus; and Mr. Hewson even doubted whether in any degree it could be called morbid. As the cartilages of the ribs were intirely ossified, the *thorax* could not be opened but by a saw, with which we happened not to be provided: but we cut through the diaphragm, and observed that the lungs were sound. No water had been collected either in this cavity or in the *abdomen*, nor were there any ulcers or purulent matter to be seen in either.

Some time afterwards Mr. Hewson showed me that portion of the *colon*, which he had cut out of the other body and had preserved in spirits: he said, that to the best of his remembrance he had taken it from the lower part of the gut. I could easily trace the resemblance between this preparation, and that which I had seen in the recent subject; though the tubercles were here more numerous, and generally higher than in the other. Dr. Hunter, who was present, did not recollect to have seen that kind of morbid appearance before, but was satisfied that the villous coat had not been separated, further than that some partial abrasions might have been seen on dissection.

These were the only bodies which were opened of those who died of the dysentery. Although there was some variety in every case, yet they all agreed in the bad state of the larger intestines. The colour and smell were proofs of the putrefaction of the blood in those parts; and the tenderness of the coats showed

that they tended to a mortification. In an external gangrene, we commonly observe some vesicles of air in the cellular membrane, which vesicles being wanting here, it may be disputed whether the mortification of the bowels was complete without them.

The tubercles, which were found in the large intestines of the last body, might have been considered as a singularity, if the dissector had not taken notice of the same circumstance in that body which he had opened before: for I can well suppose that they might have been seen in the other subjects, if I had more narrowly inspected them; and I am the more inclined to this opinion, from finding in two authors some hints to the same purpose. Thus Linnæus, in treating of the bloody-flux, says, *dysenteria epidemica scabies est intestinorum interna, ut ex dissectionibus cadaverum dysenteria defunctorum patet.** Now, for what reason that learned author uses the term *scabies*, he does not inform us; but from his using it, I would infer, that he had either seen some such eruptions, or had an account of them from others, upon whose testimony he could rely. And Mr. Cleghorn, who had frequent opportunities, at Minorca, of seeing the epidemic dysentery, observes, “that upon opening the bodies, he constantly found the great guts either entirely mortified, or partly inflamed, partly mortified; that the *rectum* was most affected; and that in many he had seen scirrhus tubercles straitening the cavity of the *colon* in several places.” † Although those tubercles, which I have described in my patient, were too flat to be taken notice of, as straitening the cavity, yet in Mr.

* Amoenit. Academ. vol. v. dissert. LXXXII.

† Observations on the Epidemic Diseases of Minorca.

Hewson's preparation they were perhaps large enough to have had that effect.

On the other hand it may be remarked, that such protuberances are scarce mentioned in the *Sepulchretum* of Bonetus,* or in Morgagni's valuable supplement. But the silence about them, in those two works, is perhaps no proof against their frequently existing, when we consider, that in Bonetus we have but a few cases (and those but imperfectly delivered) of those who died of an epidemic flux; and in Morgagni, of that sort none at all. For though that excellent anatomist has, in his usual manner, made some useful remarks upon the disease, and has added a few dissections of his own,† yet as his cases seem to have been all of the sporadic kind, I must consider them as somewhat different from such as we are now treating of. Indeed Morgagni acquaints us, that he had generally declined opening the bodies of those who died of any infectious distemper.‡

In the first dissections I mention the abrasion of the villous coat, and perhaps in my account of the last I should have made the same observation, had not Mr. Hewson been inclined to think otherwise; and had not Dr. Hunter, in viewing the preparation (which was mentioned before) been of opinion, that in this portion of the gut the villous coat had not been separated, though perhaps fissured and a little abraded on the top of some of the tubercles; and that, from the account which Mr. Hewson and I had given him of the last subject, there had been no considerable abrasion in those intestines, more than in this piece which was before him.

* Quer. whether in lib. iii. sect. xi. additam. observ. v?

† De sed. et caus. Morb. ep. xxxi.

‡ Ibid. ep. xlix. § 32.

SECTION III.

Of the Causes of the Dysentery

THE heat and moisture of the air appear to be no less the chief remote and external cause of the dysentery, than of the autumnal remitting and intermitting fevers;* and therefore when other circumstances are equal, it usually prevails in the camp towards the end of summer, or in autumn, after great and continued heats,† which, as was shown above, are generally attended with a loaded atmosphere. Upon comparing the account which I have given of the flux that occurred in every campaign, with the description of the same distemper by other authors, we shall find this principle sufficiently verified. Sydenham indeed, in the history of the epidemic dysentery of his time, takes no notice of the weather, going, I must say, upon a false principle, that the morbid constitution of the season has never any connexion with the sensible qualities of the air. But Willis supplies this defect, and observes that the summer of 1670 (which preceded the autumn wherein that flux was at its greatest height) was remarkably hot.‡ In the year 1762, the summer heats and drought were of a longer continuance than I remember to have observed them in this country; and accordingly in autumn, the dysentery was so frequent in London, that though it could not be properly called epidemic, when compared to those fluxes which I have seen in the army, yet I believe that more cases occur-

* See part iii. chap. iv. § 3.

† See part i. chap. iii. and vii. part ii. chap ii. § 1.

‡ Post æstatem impense calidam et siccam. Willis *Pharmac. Rat. sect. iii. cap. iii.*

red then, than in all the sixteen years that I had resided here. However, I do not advance this as a rule without exception; for that epidemic which raged at Nimeguen, in autumn 1736, came after a summer that was warm indeed, but to no extraordinary degree; and then none of the neighbouring towns suffered, unless by their communication with the place infected. When the question is about a remote and external cause, it is to be understood, that however prevalent it may be, it is not sufficient to produce an effect, without a concurrence of the occasional or exciting causes; and that when these last, to be afterwards mentioned, are strong, they will sometimes produce the effect, independently of other causes.

Corresponding to the remote external, is the internal pre-disposing cause, namely, a more than ordinary putrescent state of the blood, from a constant exposition to the sun in the hottest weather. We may likewise observe, that our men not caring to eat vegetables, and not being able to afford the price of fermented liquors, were in such circumstances deprived of two considerable antiseptics. For in general it may be remarked, that this disease *cæteris paribus* prevails mostly among such as are of a scorbutic (that is a putrid) habit, or among the poorer people, who from foul air, bad diet, and nastiness, are most liable to putrid diseases. And there is an old observation, that such seasons as produce most flies, caterpillars, and other insects (whose increase depends so much on heat and moisture, and consequently on corruption) have likewise been most productive of the dysentery. (115)

Hitherto we have seen how similar the causes are

(115) This remark applies equally to bilious fevers, and has often been verified in Philadelphia.

of the remitting and intermitting fevers, and of the bloody-flux. Nay, the affinity extends even to the occasional or exciting causes; such, as when in the end of summer, or in autumn, the men are exposed to night-damps and fogs, especially after a hot day, or lie upon wet ground, or in wet clothes, part of them will be seized with that kind of fever, and part with this flux; and perhaps some of them will have a disorder compounded of both. (116) Add to this, that those fevers begin to be frequent in camp whilst the dysentery still subsists; that the first symptoms are often similar, such as the rigors, and disorder of the stomach; that the remitting and intermitting fevers of a more malignant kind have sometimes ended in a bloody flux;* that such countries as are most subject to these autumnal fevers, are likewise most liable to the dysentery; and that the analogy continues even to the method of cure, in so far as the principal part of it consists in clearing the *primæ viæ*. Upon the whole, the nature of the two distempers appears so much alike, that at first sight Sydenham seems to have expressed himself justly, when he called this flux, “the fever of the season turned upon the bowels.” But upon a nearer view, we shall find this notion more acute than solid, since the circumstance of its being contagious shows that the dysentery is essentially different from these fevers. Degner offers good reasons for believing, that the fatal

(116) This fact, which has been before noticed by our author, establishes the unity of bilious fever and dysentery, nor is it refuted by the remarks contained in the subsequent paragraph. It is possible the dysentery at Nimeguen may have spread in some instances from a contagion generated by filth and confinement; but contagiousness is no more a part of the character of the dysentery, than of a bilious fever.

* Th. Barthol. Hist. Anatom. cent. ii. hist. LVII

dysentery at Nimeguen was owing to the infection communicated by one person;* and if the strangers suffered so little, in particular the Jews,† we must ascribe that circumstance to the small intercourse which they had with the people of the place.

In camp, the contagion passes from one who is ill, to his companions in the same tent, and from thence perhaps to the next.

The foul straw becomes infectious. But the great source of infection seems to be the privies, after they have received the dysenteric excrements of those who first fall ill. The hospitals likewise spread it; for those who are admitted with the flux, not only give it to the rest of the patients, but to the nurses and other attendants on the sick.

In general, the contagion is not suddenly diffused. For whole towns and camps are never seized at once by the impurity of the atmosphere; but the infection is carried from one to another by the *effluvia*, or clothes, or bedding, &c. of the tainted person, as in the case of the plague, smallpox and measles. But the dysenteric *miasma* is of a less catching nature than any of these; so that in the milder epidemics it may pass unnoticed, as in those described by Sydenham and Willis, as we observed before.‡

But of what nature is this infection? In the former editions of this work, I considered the spreading of the distemper as owing to putrid exhalations from the humours of those who fall first ill of it; and when this *miasma* is received into the blood, I conceived it to act upon the whole mass as a ferment, disposing it to putrefaction. But I am now sensible that this *hypothe-*

* Histor. dysent. bilioso-contag. cap. ii. sect. XLVI. et seq.

† Ibid. cap. i. sect. xxxv.

‡ Page 112.

sis would be insufficient, without proving at the same time, that when the blood is thus tainted, the vitiated part of it, by a certain law in the animal economy, must be thrown upon the intestines for excretion. This notion, of a putrid ferment, received some confirmation from a case which occurred, of one who was seized (indeed in a slight degree) with a dysentery, accompanied with bloody stools, in making experiments upon human blood, which had become putrid by standing some months in a close phial. This case seemed to be the more decisive, as it happened at a time when the distemper was not heard of, and to a person in perfect health, who had formerly attended many dysenteric patients without being infected.

For these reasons I was inclined to refer the *causa proxima*, or immediate cause of the disease, to this putrid ferment; but having since perused a curious dissertation published by Linnæus in favour of Kircher's system of contagion by *animalcula*, I think it reasonable to suspend all *hypotheses* till that matter shall be further inquired into.*

* *Amoenit. Academ. vol. v. dissert. lxxxii.* This dissertation, which is intitled *Exanthemata Viva*, is, as well as the rest of that work, in the form of an academical exercise made by a student; but the whole having been published by Linnæus, is considered as his own doctrine. I shall transcribe what that learned author says upon the dysenteric contagion, as the book may not be in the hands of every reader. Hanc (scil. dysenteriam) per secessus et cloacas communes propagari, ne ullus quidem medicinæ peritus ambigit. Medicum Danum, priori seculo Helsingburgi, dysenteria sæpius correptum, excreta sua alvina observasse vivis referta, viz. observabili motu se agitantibus, insectis Bartholinus narrat. Quo loco non nobis est prætereunda observatio rem maxime illustrans. Quatuor adhinc annis Dom. Rolander, in ædibus N. D. Præsidis enutritus, dysenteria infestabatur; rhabarbarinis et paregoricis, more recepto curabatur. Octiduo abhinc in eundem incidit morbum, similiterque sanatur; octo vero aliis di-

In accounting for the dysentery, it may be remarked, that I have not attributed the disease either to fruit, or to the bile; though almost all authors in treating of it have accused one or other, and sometimes both. Sydenham however ought to be excepted. As to fruit, having in other parts of this work offered several reasons for believing that it has no share in pro-

ebus præteritis dysenteria tertium corripitur: in causam omni studio inquiritur, non vero invenitur, quum æger eadem mensa, vitæque genere cum cohabitantibus sanis frueretur. Itaque N. D. Præses ægro, Entomologiæ præcipue studioso, excreta suadet scrutari, quo certius adpareret, utrum allata Bartholini observatio obtineret, nec ne. Hoc facto, in hisce myriades animalculorum se vidisse, quæquæ accurate descripta, esse acaros, et acaris quidem farinæ similes, æger dixit. Causam vero non nemo in potum nocturnum conjiciebat: sed neque hæc aliis videbatur sufficiens. Interedendum bibere insuetus erat: noctu igitur siti pressus e poculo, ex ligno juniperino confecto, potum sæpe hauriebat tenuissimum. Vas hocce inspiciens, lineolam quasi albicantem, oculis nudis vix conspicuam, inter costarum rimas reperiebat; armatis vero observavit, omne hoc albidum non aliud esse quam innumeros acaros, et ejusdem quidem speciei cum illis quos in excretis observaverat. Potu in vas infuso, non mutabantur; eos vero relictis sedibus, media nocte, potus superficiem petere, ubi ad horam usque decimam a. m. pastum quærebant, dum priora loca repetebant, crebra tandem investigatione invenit. Exemptis acaris orbiculo humectato impositis, quam parum, variis adfusus liquoribus, irritarentur, et quod per oleum ipsum salvi transirent, animadvertit. A spiritu vini lædebantur, maxime vero a tinctura rhabarbari, quod imprimis notatu dignum; quum autem rhabarbarum dysenteria sit specificum, lapathumque acutum ei valde cognatum, et quotodiana scabiei medicina, affinitatem invenimus et analogiam. Vasi, ter licet aqua calida abluto, adhærebant. Illos in aliis etiam locis quærebat, inque vasis potus acidi, & sub doliorum obturamentis sæpius reperiebat. Dysenteria quæ Scaniae territorium Gyngæ quotannis fere, tempore messis, vexat, æque ac ea, quæ in castris est vulgaris, ex iisdem acaris, in potu acido latentibus, qui inde per secessus propagantur, et contagium generant, originem suam fortassis traxerit.

ducing this flux,* or indeed any of the military diseases, I need not repeat them here. But with regard to the gall, as I have called the dysentery one of the bilious disorders, some reason may be expected for my taking no notice of that humour upon this occasion. It may be remembered, that I have always used the term *bilious* more in compliance with the ancients, to distinguish a certain class of diseases, than from an opinion that they are really occasioned by the bile. In this light I consider the autumnal remitting and intermitting fevers, which I often call *bilious*. And as to the dysentery, I shall observe, that though at first, from the sickness of the stomach and vomiting, the gall may seem to be concerned, yet in the advanced state of the disease it must be wholly acquitted; since upon dissection, the liver and smaller intestines are generally found in a natural state, though these parts ought to be the most liable to be affected by disorders of the bile. And as to the bile itself, do we not see it sometimes here in a large, sometimes in a small quantity, sometimes of one colour, sometimes of another, sometimes thick, sometimes thin, and at other times of a natural consistence? Now had it any share in bringing on, or supporting this disease, should we not find a greater uniformity in its appearance? Nay, I have even imagined, that such medicines as could procure a more copious secretion of the bile would often prove useful, having observed the patient most relieved, whenever an evacuant acted in such a manner as to carry down with it much of that humour.

* Part i. ch. iii. Part ii. ch. ii. § 4.

SECTION IV.

Of the Cure of the Dysentery.

THERE are few acute distempers less beholden to nature for a cure, or attended with more deceitful indications. The hemorrhage seems to require repeated bleedings; the flux, strong astringents; the pain of the bowels, constant opiates; and yet unless these remedies are used with caution, they tend more to confirm than to remove the disease. On the other hand, emetics and purges have been either wholly condemned, or too sparingly used: yet later experience shows them to be the chief means of the cure. But setting aside for the present all indications (which, from our imperfect knowledge of the animal economy, we are seldom enabled to form) I shall proceed to offer the result of my experience, and add some observations from others whom I could most rely on, and who have likewise been much conversant with this flux. With these further lights the nature of the disorder being more clearly seen, the reader may perhaps be directed to some more certain method of cure than what has yet been practised.

In order to proceed with more clearness, I shall distinguish the dysentery into three states: *viz.* the first, whilst it is recent, or whilst the sick can easily bear evacuations; the second, when the distemper is of a bad kind, or has continued long, and has much impaired the strength, inflamed the intestines, and brought on a hectic fever; and the third state, when the patient, though recovering, is kept low by a *tenesmus*, or some other remains of the disease; or becomes subject to frequent returns of a looseness, from the weakness of his bowels.

I. In the first state, I begin with a moderate bleeding; though it may be true that a dysentery of itself does not require that evacuation;* but as this disorder is partly of the inflammatory kind, and is often accompanied with a fulness of blood, bleeding is sometimes indispensable, and indeed is generally conducive to the cure. Yet unless the fever be kept up by some inflammation not peculiar to the disease (as it frequently happens in the winter and vernal cases) repeated bleedings are either unnecessary or hurtful, as may be observed in most distempers arising from a putrid cause. In weakly habits, and where there are few feverish symptoms, I wholly omit that evacuation.

In the evening of the same day I give an emetic. In the beginning of my practice in the army, I used the *vitrum ceratum antimonii*, which I had formerly observed to be the best medicine in this case for relieving both the stomach and the bowels. But as the virtues of that antimonial preparation have been fully set forth elsewhere,† I shall say nothing of them here, and only observe, that though I was convinced of its being a powerful remedy (by seeing it often succeed when other things had failed) yet the roughness of its operation, and the prejudice conceived against the *glass of antimony*, as a medicine, having deterred the other physicians of the army, and the regimental surgeons from using it, I also desisted, being desirous of ascertaining the efficacy of some other method that was less exceptionable. Instead therefore of this preparation, I ordered a scruple of ipecacuanha; and for the common men, I generally added one grain or two of emetic tartar. Whether I gave the weaker or the

* Dysenteria qua dysenteria venæsectionem nunquam indicat. Barbette *Prax. lib. iv. cap. v.*

† Med. Essays, vol. v. Mem. de l'Acad. des Sc. A. 1745.

stronger vomit, I observed it to be most successful when it likewise operated by stool. This effect was the more certain, when instead of the usual quantity of ipecacuanha, five grains only were given at once, and repeated at an hour's distance, twice or thrice, till a purging was brought on, which usually happened soon after the third dose. Fifteen grains exhibited in this manner were commonly sufficient. Piso, who first described this root, and recommended it in the dysentery, appears to have relied chiefly on its purgative quality, though he adds, that it still had a better effect when it vomited also.* When the stomach is chiefly affected, I give the ipecacuanha, either by itself, or with the tartar emetic, in the dose above mentioned; but when the person complains more of gripes than sickness, I direct the root to be divided as above, with a view to its more certain operation

* Perhaps the medicine is more cathartic while fresh than after long keeping; and better in decoction, or infusion, than in substance. We may observe, that Piso recommends the second and third decoction for weak patients, as less cathartic and more astringent. The following is the principal passage which relates to the use of this specific: Dehinc ad radicem ipecacuanha tanquam ad sacram anchoram confugiendum, qua nullum præstantius aut tutius, cum in hoc, tum in plerisque aliis, cum, vel sine sanguine, fluxibus compescendis, natura excogitavit remedium. Quippe præterquam quod tuto et efficaciter tenacissimos quosque humores per ipsam alvum, sæpissime autem per vomitum ejiciat, et a parte affecta derivet, vim quoque astrictivam post se relinquit.—Illud vero hoc modo perficitur: Drachmæ duæ radicis ipecacuanha in ℥iv. liquoris appropriati coctæ vel per noctem maceratæ, cujus infusum cum, vel sine oxymellis ℥j exhibetur. Postridie semel atque iterum, pro re nata, secunda imo tertia ejus decoctio repetenda; tam quod ægri debiliores eam facilius ferant, quam quod astrictoria ejus vis tunc magis efficax appareat. GUL. PISON. Hist. Nat. et Med. Indiæ Occident. lib. ii. cap. ix.

upon the bowels. In one or other of these forms, I give the emetic on the first day of my seeing the patient, whether he has been bled or not. If the full quantity be given, the operation is assisted, in the common way, with repeated draughts of camomile tea. But if the small doses be used, he ought to drink nothing till the medicine works downwards, and then he may take some water-gruel to promote its effect.

When the stools are large and bilious, and the patient fatigued with the operation, I give no medicine on the following day; but if he has taken the emetic all at once, so as only to clear his stomach, or if the divided doses have wrought weakly by stool, I order a purge next morning, *viz.* five grains of calomel, with five and twenty or thirty of rhubarb, which in ordinary constitutions is a moderate, or rather a small dose. At first I gave the rhubarb without any calomel, and usually about half a drachm; but afterwards I found it necessary either to double that quantity, or to join calomel to that, or to a smaller dose, in order to procure a thorough passage. I have remarked in the former editions of this work, that “ we are to attend less to the dose than to the effects, which are not to be judged of by the frequency, but by the copiousness of the stools, and the relief which the patient finds from the gripes and *tenesmus* after the operation; and that as on the one hand the physician ought to avoid all the rough and stimulating purges, so on the other he is not to spare those of a lenient kind, especially rhubarb, which is commonly under-dosed.” This is still my opinion, except that with regard to rhubarb, I have not seen it in this flux have so good an effect as when joined with well prepared calomel, by which means it becomes more lenient, that is, easier in its operation.

At night, after the purge, I usually give for the first time an opiate, *viz.* ten grains of the *pilulæ saponaceæ*, with two, or sometimes with three grains of ipecacuanha, either in a bolus or in a draught: for ever since I found that some common soap pills had passed undissolved, I have disused that form in all weaknesses of the intestines. Formerly I joined to the opiate a small quantity of the *vitrum ceratum antimoni*, in order to promote perspiration; but when I dropped that medicine as an emetic, for the reasons already given, I omitted it here also, and supplied its place with the Indian root.

Here I must observe with regard to opiates in the dysentery, that it were better perhaps that they were never given at all, than used before the first passages are cleared. For though from the beginning they are sure to give some immediate relief, yet by confining the wind and the corrupted humours, they tend to fix the cause, and to render the distemper more obstinate in the end. This is the result of my experience, which I am sorry to find does not exactly correspond with that of Sydenham. For though that excellent physician did not omit purging when the dysentery was most epidemic, yet at all other times it appears that he trusted to laudanum alone. Now, whatever was the nature of those fluxes which he treated in that manner, I must believe that such as are most incident to an army are of a less tractable nature, and in general are not to be cured without repeated evacuations. As to the best kind of opiate, I have made no particular observation; and therefore if I have here specified the *pilulæ saponaceæ*, it was only because I preferred that composition to the simple *extractum Thebaïcum*, as there was less hazard of an error in the weight. It is

well known that ten grains of these pills are equal to one of pure opium.

If the two first days have been employed in the manner described, I order no medicine on the third, unless the patient still complains of gripes; in which case the opiate is repeated at night. But on the fourth day, if any bad symptoms remain, I direct the ipecacuanha to be given once more in divided doses; or, if the patient should express great aversion to a drug which made him sick before, I repeat the purge, and that in a larger dose if the former has not operated sufficiently. The largest of this kind, which in such cases I have used, consisted of thirty grains of rhubarb with eight of calomel.

By this time most of the dysenteric cases give way, and sometimes sooner. But if some *fomes* of the distemper still remains, or if the patient has committed any error in diet, or has exposed himself to cold, so as to relapse, I have recourse to the same remedies, that is, either to the purge, or to the ipecacuanha, according as the one or the other has agreed with him before. In fine, these evacuants are the chief medicines which I trust to in this stage of the disease.

This method was nearly followed in the last war by the other physicians of the army, and in particular by Dr. Huck, who having been in constant service either in North-America, or in the West-Indies, had the best opportunities of seeing the dysentery in all its forms. He acquainted me that, notwithstanding the difference of climates, the distemper, when epidemic among the troops, appeared with much the same symptoms every where, and when cureable yielded to the same medicines. Believing it will be acceptable to the reader, I here subjoin a short account of Dr. Huck's practice in his own words.

“ When the patient is feverish, or plethoric, I always begin with bleeding; and if the fixed pains and the fever seem to indicate a considerable inflammation, I repeat it. I have thought, that giving four or five grains of ipecacuanha with one grain of emetic tartar, without drinking after this dose, but suffering it of itself to work off, and repeating it in two hours, with orders to the patient to wash his stomach with camomile tea, was the best method of clearing the first passages. Sickness at the stomach, bad taste in the mouth, giddiness, heart-burn, and severe gripes were reasons for repeating the vomit on any of the following days. If the stomach did not seem much disordered after it, I used to purge with two ounces of manna and one ounce of Glauber’s salt dissolved in a quart of water, whereof a quarter of a pint was drunk every half hour till it procured two or three copious stools. This I preferred to rhubarb and to every other cathartic, especially in the beginning, repeating it every third or fourth day till the gripes, &c. abated, and giving an opiate every night, after the first or second dose of the physic. But I never knew an opiate of use whilst the fever, the thirst, the gripes, and *tenesmus* were considerable. If astringents were useful, it was only when a laxity of the bowels remained after the disease.”

By this account, we find that Dr. Huck not only divided the ipecacuanha, but to each of the doses added some emetic tartar, which upon a comparative trial was found to improve the medicine. And indeed for the future, I should prefer his method, as I have reason to believe, from my own observations upon the bilious fevers, that this antimonial preparation may be of service in removing some feverish spasms, which,

though not the original cause, may yet concur with it in supporting the disease.

We may likewise observe, that Dr. Huck thought the salts and manna a better purge than rhubarb, in the beginning of the dysentery; but in talking with him on this subject, I found, that though he had frequently given rhubarb by itself, yet he had never given it with calomel, and therefore that he could not determine whether his purge or mine were the best in this state of the distemper. (117)

I likewise understand, that most of our physicians employed in Germany, during the late war, preferred salts and manna (to which they frequently added some oil) to rhubarb alone; and that after bleeding and vomiting, they usually kept the body open with that mixture.* Possibly there may be better ways of giving the rhubarb than with calomel. Degner praises a tincture of it in a watery *menstruum*, of which he gave small but frequent doses; but as I never saw his treatise till after the conclusion of the former war, I have

(117) That active purges are rendered more certain and gentle in their operation, when given with such as are of a mild nature, than when given alone, was first noticed by Dr. Sydenham. It is equally true that many of those articles in the materia medica which have obtained the title of "heroic" medicines, are rendered more safe, and more useful by being combined with medicines of a more gentle nature:

* Dr. Monro, one of the physicians on that service, told me, that he had commonly given in the dysentery a purge in this manner:

R *Mannæ* ℥β *vitelli ovi* ℥i. *contritis simul, in mortario lapideo, admisce paulatim olei olivarum* ℥vi. *salis cathartici amari (aque puræ ℥iij. soluti)* ℥j.

This was the dose for a strong person, but to the weakly patients he gave a smaller quantity. Dr. Armstrong and Dr. Turner, who were likewise of the army in Germany, also informed me, that they had used much the same composition.

since that time met with too few rebellious cases, to induce me to compare his preparations with those remedies which I had used before, with tolerable success. *

After clearing the first passages, in the manner described, I have generally endeavoured to finish the cure by combining purges with opiates, in such a manner as to keep the body open, and at the same time to appease the gripes, but I have not always succeeded to my wish. In the year 1760, the brigade of guards arriving in Germany, about the end of July, in a rainy season, and when there was a scarcity of straw for the tents, such numbers of the men were taken ill, and for the most part with the dysentery, that when the camp broke up, in the month of December, above half of that corps were unfit for duty. Mr. Paterson (one of the master-surgeons to the hospital, then a mate in the guards) who gave me this information, told me, that he had been generally successful, by treating those of his battalion, who had been ill of the flux, in the following manner: “ If the patient was of a plethoric habit and very feverish, he began with bleeding; “ then gave a vomit of ipecacuanha; and besides that, “ if he had seen the sick person early in the day, a

* It may seem strange, that authors have not yet agreed about the proper purge to be used in the dysentery; but we ought to consider that different constitutions require different laxatives. A physician, in his first practice, not attending to this, and meeting with a dysenteric patient, with whom rhubarb, for instance, agrees, and sena or salts disagree, will be afterwards apt to adhere to the first and condemn the other; and *vice versa*. But as to the use of purges in this disorder, and the variety of them occasionally to be employed, according to the difference of constitutions, we have such full and just reflexions in Young's Treatise on Opium (in the section on the dysentery) that I shall not further insist on the subject, but refer the reader to those judicious observations.

“ drachm of rhubarb at night; if not, the next morn-
“ ing. In the evening of the second day, after the ope-
“ ration of the purge, he gave about twenty drops of
“ laudanum, or about ten grains of the *pilulæ sapo-*
“ *naceæ*. After that, if the disease continued, he for-
“ med a mass of *theriaca* and rhubarb into the consist-
“ ence of pills, and of this administered half a drachm
“ morning and evening, and sometimes thrice a day.”
Mr. Paterson added, “ That, the next year, when he
“ himself was seized with the bloody-flux, he had
“ followed the same method of cure; that it was near
“ three weeks before he recovered, being constantly
“ kept in camp, frequently marching, and being ex-
“ posed to cold, wet, and other hardships in the course
“ of his duty; but that during all the time, he had
“ found the greatest benefit from the medicine above
“ mentioned. That about half an hour after every dose
“ the *tenesmus* abated, and the stools became more
“ copious and less frequent for three or four hours
“ following. That on this account, for the last seven
“ or eight days, he took half a drachm of the above
“ composition thrice a day, which amounted to about
“ one drachm of *theriaca* and half a drachm of rhu-
“ barb in twenty-four hours.”

If by the means above mentioned, or by other methods, the disease is so far changed that the patient complains less of gripes and *tenesmus*, and begins to have stools, though loose, yet of a natural colour, with less slime and more *fæces*, he being then in a fair way of recovery, his case shall be further considered when I come to treat of the third state of the disease. At present I am to treat of those who have gone through the first state, and who either have had no medicine at all, or received little or no benefit from it; and when

their stools are as small, as frequent, as slimy, and as painful as ever.

II. In the second state, though there be often more of a hectic fever than at first, and though a mortification be threatened by the retention of the putrid matter and the continuance of the inflammation, yet, so far as I have observed, bleeding is not the remedy, but laxatives (such as have little irritation, and yet are sufficient to prevent an accumulation of the sharp humours) and those medicines which either sheathe the bowels against the acrimony, or procure a respite from pain and spasms till nature acquires force sufficient for the cure. Here for the first time I used the *sal catharticus amarus* alone, though probably it might have been more effectual with oil and manna, or given not at once but in small and repeated doses, as in the *ileus*.* In this state I once gave, to a young woman, five grains of ipecacuanha with twelve of rhubarb, which first making her sick, and then working downwards, brought away some *fæces* of a natural colour, and gave a favourable turn to the disease. But as this person was one of my latest patients in a dysentery, I have had no opportunity of repeating that medicine.

At this period of the flux, finding emollient and anodyne clysters to be of considerable benefit, I therefore used a decoction of linseed, or of starch, or fat mutton broth, from four to eight ounces, according as a smaller or larger quantity could be retained. When the motions were so frequent, that the patient could not keep these clysters, I added to each from twenty to fifty drops of laudanum, or as much as was necessary for abating the *stimulus*, without too much affecting the head. As the patient must

* See page 135.

use opiates, this will probably be found the best way of giving them; for thus they are applied directly to the *rectum*, where the irritation is the greatest. But in bad cases the motions are generally so frequent, that, notwithstanding the laudanum, one clyster given in the evening may be insufficient for composing the patient throughout the night; and if so, he must either take another, or the common opiate. Although the advantage of clysters be visible, yet we cannot avail ourselves of them in the hospital so often as could be wished, partly through the neglect of the nurses, and partly through the reluctance of the men to use them: even in private practice, we must often desist from clysters on account of the tenderness of the parts.

For mitigating the gripes and expelling the wind, we are not to use the warmer carminatives; at least I have never known them to answer. Opiates give immediate relief, but they only palliate, and often augment the cause. I have met with no remedy that remarkably answered this intention: the best, was fomenting the belly, and drinking camomile tea. The infusion of these flowers was first thought of on account of their antispasmodic and bracing qualities, but having found them a powerful antiseptic, I am inclined to think that some of their effects may be owing to that principle. The fomentations were made of the common herbs, with the addition of some spirits; but as they required frequent repetitions, they were less used by the soldiers than by the officers, who were better attended. The flatulent pains would sometimes affect the side, as in a pleurisy; but a laxative medicine, or the fomentations just mentioned, removed them without bleeding.

When the patient complained of a heart-burn, and of every thing turning sour on his stomach, I ordered

from time to time four spoonfuls of the *julepum e creta*; and when at the same time the gripes and incessant motions required some palliative, I dissolved two grains of *extractum Thebaicum* in a pint of that julep, and gave it in the manner mentioned before.*

At other times, when there was no complaint of an acid, but of gripes and frequent motions, I endeavoured to blunt the acrimony, and in some degree to sheath the bowels against the irritation, by food of a mucilaginous quality (which shall be mentioned hereafter) and by giving for drink a decoction of starch with gum-arabic, seasoned with some simple cinnamon water and sugar. A pint of this liquor commonly contained three drachms of starch with half an ounce of the gum. For the same intention, a solution of wax was used in the hospitals in North-America, and, as Dr. Huck informed me, often with good effects. † Preparations of wax have been long in repute for their virtues in this disorder: Bates recommends a solution of it in spirits; ‡ and Diemerbroeck gives instances of its extraordinary effects, when dissolved in milk, and mentions some authors who praise this medicine for the dysentery. § (118)

* Page 185.

† R *Cera flavæ rasa* ℥iβ. *saponis Hispani duri rasi* ℥i. *aquæ puræ* ℥i. *liquescant leni igne, et assidue agitentur donec in unum coeant; dein effunde materiam in mortarium lapideum, eique paulatim admisce aquæ puræ* ℥viii. *aquæ nucis moschatæ* ℥j. *et sacchari albi quod satis sit ad gratum saponem.*

This makes a smooth mixture of no disagreeable taste, whereof the patient takes as much, at proper intervals, as to consume the whole quantity in a day; which is then to be renewed. The soap is only used as a dissolvent of the wax.

‡ Pharmacop. Batean. in formula *Butyrum Cerae*.

§ Observat. et Curat. Med. obs. xxviii.

(118) From some trials that have been made with beeswax in

When the flux continues till the strength is much impaired, and the pulse sinks whilst the hectic heat remains, the danger is great; though there are still hopes, as long as there are neither involuntary stools, nor *aphthæ*, nor a hiccup, and when the patient does not complain of great lowness, and the *anxietas præcordiorum*: then the case is bad indeed, and scarcely admits of palliatives; since opiates have but little effect, either in easing the pain, or checking the frequency of the stools. Sometimes the disease is complicated with the hospital-fever; in which case few recover. But when there is room for medicine, I have commonly used a decoction of the bark with snakeroot (described in the next chapter) to which I added a few drops of laudanum. At other times, and especially when the pulse was sunk, I have experienced the good effects of the following decoction, of which four spoonfuls were given every four or five hours:

℞ *Radici serpentariæ Virginianæ* ℥iij. coque ex aquæ fontanæ ℥xij. ad ℥viiij. abjecta sub finem coctionis theriacæ *Andromachi* ℥j. cola.

In the year 1760, Dr. Whytt wrote to me: “ That
“ in this bad state of the dysentery, when the mouth
“ and alimentary canal were threatened with *aphthæ*,
“ and even sometimes after they appeared, he had

chronic dysenteries and diarrhœas, I am disposed to ascribe its efficacy in restraining them, wholly to the powerful and ineffectual efforts of the stomach to digest it, whereby the excitement is attracted from the intestines, and their morbid peristaltic motion thus diminished. This opinion is rendered probable by its having done most service when it was given in a simple state, in which case it was discharged in some experiments made by Dr. Vandyke, in the same form in which it was taken. It is probable, mutton-suet, and milk, and many other medicines, supposed to be demulcents, and astringents, act in the same way in curing chronic fluxes from the bowels.

“ successfully given the bark; having first made such
 “ evacuations as the case required, or the patients
 “ could bear, by bleeding, vomiting with ipecacuanha,
 “ and purging with rhubarb. That to a pint of a
 “ strong decoction of the bark, he added three
 “ drachms, or half an ounce of *confectio Japonica* (a
 “ composition of the Edinburgh Dispensatory, of the
 “ same intention with *diascordium*, but simpler) and
 “ ordered two spoonfuls of it every four hours, with-
 “ out any other medicine, except some laudanum at
 “ bed-time. That when, by the continued use of this,
 “ the body became costive, he then gave rhubarb; and
 “ after that, went on with the decoction of the bark,
 “ but with less of the *confectio Japonica*, or even
 “ without it.”

At this time, supposing that the *rectum*, from the irritation occasioned by the incessant motions, tended to a mortification, I endeavoured to quiet the spasms by repeated anodyne clysters, but without any antiseptic ingredient. Something however of that kind has been tried by others. For Mr. Hunter, one of the master-surgeons on the expedition to Portugal, told me, that he had frequently used antiseptic clysters with good effect, when the patient was worn down with continual motions and a *tenesmus*. His first trial was with four ounces of a strong decoction of the bark, in which he dissolved some grains of opium; and afterwards, he found that a decoction either of the tormentil-root, or of oak-bark with opium, answered the same purpose. He added, that these clysters were repeated often, and especially if they came soon away without having the desired effect.

Hitherto I have said nothing of the diet; which was nearly the same in both these states of the disease. It consisted chiefly of rice or barley-gruel, sago, panada,

and some puddings; and to those who were but a little feverish, some mutton broth was allowed: but this last article was omitted afterwards, as I observed that in general animal food was improper. For drink, I ordered rice or barley water, toast and water, or the decoction of calcined hartshorn. During the former war, we used no salep in the hospital. Although that root has been accounted specific in the distemper, yet from my own experience I can say nothing particularly in its commendation. Mr. Triquet, surgeon-major to the second regiment of guards, informed me (at the camp in the isle of Wight, in the year 1758) that in his regimental hospital, no kind of diet had agreed so well with his men who were ill of fluxes, as a mess made of flour boiled in milk, sweetened with sugar, and taken for breakfast and supper. But though all these substances are of the softest and least heating kind of food, yet I have observed, that for the most part the patient could not eat any of them, nor swallow any of the liquors mentioned above, nor indeed any other, except plain warm water, without being sick or griped immediately after. It was therefore natural to conclude, that until the stomach and bowels were able to bear some stronger nourishment without pain or sickness, nothing but water should be given for the whole diet. In this notion I was confirmed by some curious observations on the dysentery, communicated to me by M. de Senac, who, during my service in the Low-Countries, in the former war, was physician-general to the French army. That learned person informed me, that having had good evidence for believing that several had been cured by taking nothing but large quantities of warm water, for five or six days together, he had successfully made the experiment upon himself, and upon fourteen more who submitted to that

regimen. He added, that after having tried other methods, without being satisfied with them, he had at last fixed upon the following, by which he had made numberless cures. This, after evacuating by bleeding, and by a vomit of emetic tartar, consisted chiefly in giving one grain of that antimonial preparation, dissolved in a pint of common whey, or chicken water, in divided draughts, every day, for all food, drink, and medicine till the patient recovered. His intention, he said, was to keep a free passage from the stomach to the *rectum* by the mildest laxative, which he found was best answered by that minute quantity of the emetic.*

In case the gripes proved more obstinate than usual, notwithstanding the evacuations, he then endeavoured to quiet them, by giving some syrup of white-poppies at bed time. But though this course (in which the lowness of the diet is a material circumstance) was not only agreeable to my sentiments upon the nature of the disease, but was recommended to me by a physician, in whose judgment and veracity I had intire confidence, yet I have never been able to avail myself of the communication, on account of the difficulty, I may say the impossibility, of making the people of this country submit to so low a diet, even for a few days. (119)

* As the emetic tartar is not every where made to the same standard, it is easily understood that the laxative dose must vary according to the preparation of that medicine.

(119) There can be no doubt of the efficacy of this practice in dysenteries of a moderate grade of diseased excitement. It is a chronic mode of depletion, but it should not be relied upon exclusively in the violent dysenteries of the full-fed, and high-toned citizens of the United States. Redi mentions a fact, much in favour of the practice advised by M. de Senac for the cure of dysentery. He says that he found the intestines of all the animals he dissected that had died of famine, not only free of excrement,

Under the article of diet, I must not omit a caution with regard to the kettles of the hospital, which are all made of copper tinned; but as the tinning soon wears off, the metal is corroded by every thing that is salt or acid; and we may well imagine how apt the nurses will be to let such things stand long in those vessels, and to neglect cleaning them before they are again used. I suspect that this may be often the cause of mischief, especially during the dysenteric season, when the stomach and bowels are otherwise so much disposed to be out of order. It would therefore be an advantage to military hospitals, to have a brazier constantly attending them.

III. I come now to the third state of the disease, in which the patient, though seemingly recovering, is kept low by a *tenesmus*, almost his only complaint; or by frequent returns of a looseness, through the weakness of his bowels.

The *tenesmus* is not always owing to one cause: sometimes I have known it occasioned by the hard *scybalæ* formerly mentioned, which coming away in small parcels, for several days together, have made a constant irritation. The discharge of these I have hastened by an ounce of Glauber's salt, dissolved in half a pint of water, and given at different draughts in a morning. If one or two such doses had no effect, I imputed the continuance of the *tenesmus* to an excoriation, or some sore of the *rectum*, by which the part becomes so tender as to be irritated by the humours of the intestines, though these humours may now, perhaps, be sound. For medicine, if the *tenes-*

but perfectly clean and of a white colour. Considering how much the secretions in the bowels are altered by disease in their *quality*, it is natural to expect that diluting drinks by obviating their acrimony, may contribute to the cure of dysentery.

mus was great, and the motions frequent, I had still recourse to opiates, and especially to the anodyne clysters first mentioned.* In every case of great irritation, during this state of the disease, I used formerly to give the decoction of starch with gum-arabic, described above;† but of late I have more frequently prescribed mutton-suet, prepared according to the following receipt, which for some time has been in use here; “ Take two ounces of fresh suet, and a pint of
 “ new milk, set them over a slow fire, and let them
 “ be stirred till they boil, then add a heaped spoonful
 “ of starch finely powdered, and mixing it well with
 “ the rest, let them boil a little together.” This preparation may be sweetened, or not, according to the taste: and this quantity, or even the double (if the stomach will bear it) may be consumed in a day, and it will have the better effect if the patient takes no other food. I have sometimes attempted to give this medicine in the first and second state of the disease, but it never answered; for at that time the stomach was too much disordered to bear it.(120)

Sydenham has said, that the *tenesmus*, at the end of a dysentery, is never occasioned by an ulcer in the *rectum*; in which he is corrected by Morgagni, who mentions one case to the contrary, that had occurred in his own practice;‡ but by quoting that case only, it appears that Morgagni knew but of few exceptions to Sydenham’s rule; which indeed, from my own observation, I should reckon a pretty general one.

As to the frequent returns of purging, we are not,

* See above, page 239.

† Page 242.

(120) The editor has often relieved a *tenesmus* by applying a piece of cotton dipped in equal parts of laudanum and sweet oil to the part affected.

‡ De Sed. et Caus. Morb. ep. xxxi. § 27, 28.

as I observed before, to consider them so much as relapses into the dysentery, as into a *diarrhœa* or white-flux, owing to the weak state of the bowels.

Whenever therefore the patient is in this condition, I begin with a scruple of ipecacuanha, and the next day I put him upon a course of those medicines, which, from their effects in stopping a looseness, have been called astringents. For this purpose, during the former war, I commonly used the following mixture:

℞ *Extracti ligni Campechensis (ex aquæ cinnamomi spirituosæ*
℥i℞ triti) ℥iij. aquæ fontanæ ℥viij. tincturæ Japonicæ ℥ij.
miscæ.

Of this the patient took two spoonfuls once in four or five hours, and sometimes also an opiate at bed-time. I understand, that in one of the hospitals of this city, where this *formula* is used for old and obstinate *diarrhœas*, and for dysenteries not yielding to the common methods, they order, at the same time, a bolus to be taken every night, consisting of a scruple of *philonium Londinense* and two grains of ipecacuanha, and that with these two medicines they have been generally successful.

Since that war, having read the account which Degner and others have given of the virtues of the *simaruba*, I made a few trials of that medicine, and which were mostly in its favour. Degner not only recommends it as a mild astringent, but as a corrector of the bile; for according to his theory, the depravation of that humour was the cause of the epidemic flux which he treats of. On that account he gave it early in the disease, whilst the gripes and *tenesmus* continued, and whilst blood was yet found in the stools. But from my experiments, I could discover none of the salutary effects of the *simaruba* before the third state. Dr. Huck, who had used it often in North-America, told

me, that he had never seen it answer in the beginning, nor even in the advanced state of the dysentery, till the gripes and *tenesmus* had in a great measure ceased, and till the blood had disappeared in the stools; but that when only a looseness remained, he had often found it succeed. This was his *formula*:

℞ *Corticis radicis simarubæ* ℥ij. vel iij. coque ex aquæ fontanæ sesquilibra ad libram, et cola.

This quantity was given every day in several draughts. He began with the weakest decoction, and when the stomach of the patient could easily bear it, he then ordered him the strongest. Dr. Huck observed, that unless the sick found themselves sensibly better within three days from the time they began the medicine, they seldom afterwards received any benefit from it. Dr. Mitchell, who formerly practised in Virginia, where the dysentery is frequent, also informed me, that he had likewise used this vegetable; but not with success, except when the patient either voided an immoderate quantity of blood during the height of the disorder, or had a *diarrhœa* after the inflammatory state was passed. He added, that he had usually made a stronger decoction than that which Degner prescribed; who probably was led to give the *simaruba* with more caution, as the bowels were so much inflamed when he began it.

I have also known good effects of small doses of ipecacuanha joined to an opiate, such as two grains of that powder with fifteen of the *philonium Londinense*, taken twice a day. Others have received benefit from ipecacuanha alone. Dr. Huck observed, that a soldier, after getting over the inflammatory state of the dysentery, was much reduced by a white-flux of the lienteric kind, and that after giving him several astringents without effect, he had at last succeeded, by or-

dering him six grains of ipecacuanha in powder, to be taken every morning fasting; that this man was puked by the medicine for the first three or four days only, and that he afterwards took it without complaining that it made him sick.

During this astringent course, the men are still to be attentive to their diet, abstaining from greens, fruit, malt-liquor and acids. In this state I have allowed them some flesh meat; and for drink, water mixed with a little rum or brandy: to the officers and private patients, I have given some wine when they were very desirous of it. But from further experience, I am convinced, that, at this period of the disease, the cures would be both more frequent and speedy, could we prevail upon our patients to abstain altogether from animal food, and from vinous and spirituous liquors: for when no astringents have availed, I have frequently known the cure obtained by a milk and vegetable diet, without them.

Therefore when the astringents fail, and especially when the pulse is quick, and the patient complains of inward heat, I first give a vomit of ipecacuanha, and then begin that low regimen, which I continue till the hectic symptoms have ceased, and the bowels have recovered their tone. During this course, I have seldom had occasion for medicines, excepting the chalk-julep mentioned before, which I use for correcting that strong acid so incident to relaxed stomachs. Sometimes I add an opiate at night in order to procure rest; but after a few days I generally lay both aside. All that I require (which indeed is often hard to obtain) is a strict perseverance in the diet; and now and then a repetition of the vomit, upon any new disorder of the stomach, or greater laxity of the bowels.

Whilst the patient continues in this state, I forbid

all animal food; and besides milk, I allow only the preparation of grain, sago, and salep. In large hospitals, the soldiers cannot be fully supplied with milk; but in such circumstances they must be contented with less, and with the other parts of diet here prescribed; without eating cheese, eggs, or other things which are heavy or heating to men in their condition. Although greens and fruit may seem to favour the general intention of cooling, yet, as they are mostly loosening, I have thought that the use of them, at this time, was less proper; but it is possible, that, upon further experience, we may find some kinds both of the one and the other conducive to the cure. And I am the rather inclined to this opinion, from having observed, in one of the latest cases, that when the patient drank butter-milk (indeed none of the sourest) he received more benefit than could have been expected from sweet milk; though the former, from an acidity, like that of some fruits, might be supposed to be contrary to the nature of the disease.

In this regimen, I allow of neither fermented liquors, nor spirits. The chief drinks are the decoctions of barley, of rice, or of calcined hartshorn, toast and water, or milk and water. Having observed, in my private practice, that some were better for drinking Bristol water, not only at the spring but at a distance, I desired one of my patients (who had come from the Havannah) to observe, whether he found any difference between drinking the river water, and the pump-water in this city; and, after some trials, he assured me that he was less liable to a return of his flux when he used the latter. Now, Bristol water and most of the pump water in London agree in not lathering with soap; that is, in being in reality hard, however soft they may be to the taste. But I would not from thence

infer, that this mineral water has no other advantage than hardness, when drunk warm at the spring; considering how long it has been in repute for its efficacy in cases of this kind, especially when hectic heats are joined.

Pure air being of such consequence in the cure, the physician can scarce be successful in full hospitals unless the wards be uncommonly well aired. The best expedient, in the dysenteric season, is to divide the sick, and to lay them in churches, or in barns, or in ruinous houses only, where neither they nor their nurses can confine the air. Not, but that expositions to cold are hurtful, and that a constant free perspiration is favourable to the cure; but when warmth is not to be had with a purity of air, we must chiefly regard the latter. Not only in the camp, but in the hospitals, the privies should be covered every day with a layer of earth; and at these times, particularly, the wards should be fumigated and kept clean. Such men as have long languished in the hospital under a hectic, and a laxity of the bowels, have been surprisingly restored, by cantoning them in the country, for the benefit of drinking milk, and breathing the fresh air.

Lastly, as conducive to the cure, and as a preservative against a relapse, especially when the weather begins to grow cold, the convalescents ought to be provided with under-waistcoats: some of the officers, who had been subject to relapses, have informed me, that they had found benefit from wearing a flannel waistcoat next their skin.

CHAPTER VII.

Observations on the Jail, or Hospital-Fever.

I COME now to the last fatal distemper, incident to an army, namely, the hospital-fever. In treating of this, I shall, 1. describe its rise, and the manner of the infection; 2. the symptoms; 3. the prognostics; 4. the dissections of some of those who died of it; 5. the method of cure: and lastly, from these and other materials, I shall inquire into the causes of such fevers.

SECTION I.

Of the Rise of the Jail or Hospital-Fever, and the manner of the Infection.

THE hospitals of an army, when crowded with sick, or when the distempers are of a putrid nature, or at any time when the air is confined, especially in hot weather, produce a fever of a malignant kind, and often mortal.* I have observed the same sort to arise in full and crowded barracks; and in transport-ships, when filled beyond a due number, and detained long by contrary winds; or when the men have been long kept at sea under close hatches, in stormy weather. Hospital-ships, for distant expeditions, have for this reason been generally destructive both to the sick and their attendants.

As soon as I became acquainted with this fever in the hospitals abroad, I suspected it to be the same with what is called here the *jail-distemper*, which I had

* Part i. ch. ii. iii. iv. viii. Part ii. ch. iii. § 3.

never seen; and I was confirmed in my opinion, by having an opportunity of comparing them, furnished by an accident mentioned in the first part of these observations.*

This disorder is incident to every place ill-aired and kept dirty, that is, filled with animal steams from foul or diseased bodies. And upon this account, jails and military hospitals are most exposed to this kind of pestilential infection; as the first are in a constant state of filth and impurity, and the latter are so much filled with the poisonous *effluvia* of sores, mortifications, dysenteric and other putrid excrements. I have seen instances of its beginning in a ward, when there was no other cause but one of the men having a mortified limb. Nay, there is reason to apprehend, that when a single person is taken ill of any putrid disease (such as the small-pox, dysentery, or the like) and lies in a small and close apartment, he may fall into this malignant fever.(121) This I have actually known to happen in camp, when any one has been seized with such a disorder, and kept his tent too close. But excepting on a few of those occasions, this fever is not properly one of the camp-diseases, though it be universally accounted such; for being frequently seen in camp-hospitals, it is therefore erroneously supposed to come from the field.(122)

* Page 42.

(121) Many facts prove that persons may produce and infect themselves with what is called the jail fever, by means of confinement, impure air, foul linen, and unwholesome food. It is equally true that persons may thus generate the contagion of the jail-fever, and communicate it to others, without being infected by it themselves.

(122) Our author is correct in this remark. During the whole time in which the Editor acted in a medical capacity in the revolutionary army of the United States, he rarely saw an instance of

I have observed some instances of a high degree of contagion attending it; but the common course of the infection is slow, and catching to those chiefly who are constantly confined to the bad air; such as the sick in hospitals and their nurses, and prisoners in jails. But when there is no great quantity of infectious matter, or when a person has not breathed long in such dangerous steams, or when they are not particularly virulent, he will either escape altogether, or fall ill so slowly, as to give time for stopping the fever before it be quite formed. Much will also depend on the constitution: some will have the disorder hanging about them for some days before it confines them to their bed; others will complain for weeks of the same symptoms, without any regular fever; and others, after leaving the infectious place, without the fever, will afterwards be seized with it.*

SECTION II.

Of the Symptoms.

WHEN the distemper comes on slowly, the first complaints are small interchanges of heat and cold, a trembling of the hands, sometimes a sense of numbness in the arms, weakness of the limbs, loss of appetite: and the disorder being greater at night, the body is hot, the sleep interrupted and not refreshing. With these symptoms, for the most part there is some pain, or confusion of the head. The pulse at first is a little quicker than natural, the tongue is white, but the

a hospital fever in the camp. It was generally the offspring of too much crowding, filth, negligence, and something worse, in the military hospitals. The camp diseases were bilious fevers and dysenteries, rheumatisms, pleurisies, and catarrhs.

* Part i. ch. vi. p. 43.

drought is inconsiderable. Those who are thus affected find themselves too much indisposed to go about business, but too well to be wholly confined. In this state, sometimes a vomit, sometimes a change of air, will remove the disorder, sometimes a sweat: I have had experience of the two last methods of prevention in my own case.(123)

The disease, in the beginning, is not easily to be distinguished from any common fever.* I have observed the *tremor* of the hands to be one of the most constant signs: but in order to form our diagnostics we must take other circumstances into consideration. We are to inquire whether the person has been exposed to the usual causes of fevers, or to foul air and infection; as also, if he has been bled, whether he has been relieved by the evacuation; because, in inflammatory fevers, bleeding generally moderates all the symptoms, but in this it seldom has that effect.

When the fever advances, the symptoms already mentioned are in a higher degree, and in particular the patient complains of great lassitude, of a *nausea*, pains in the back, a more constant pain and confusion in the head; and then we perceive an uncommon dejection of spirits. At this time, the pulse is never sunk, but beats quick, and often varies, in the same day, both as to strength and fulness. It is little affected by bleeding

(123) Such was the reliance of the Editor while in the American army upon an emetic in curing this fever in its forming state, that he made it a practice to carry a number of doses of tartar emetic in his pocket, which he gave to such of the officers and soldiers as complained of the premonitory signs of the fever, and always with the happiest effects.

* *Febres malignas in principio statim cognoscere difficile est, cum malignitas sæpe diu lateat, et non nisi ubi vires sumsit sese prodant.* Sennert. *Efrit. de Febrib. lib. iv. chap. x.*

once, if a moderate quantity of blood be taken away; but if the evacuation is large, and especially if repeated, to answer a false indication of inflammation, the pulse, increasing in frequency, is apt to sink in force, and often irrecoverably, whilst the patient becomes delirious. But withal we must observe, that in every case, independent of evacuations, the pulse sooner or later sinks, and gives then certain intelligence of the malignity of the disease.

The appearance of the blood is various; for though it is commonly little altered, yet sometimes it will be sizy, not only on the first attack, but after the fever is formed. The worst appearance is when the *crassamentum* is resolved; though this does not happen till the advanced state of the disease: but indeed as the blood has then been so seldom taken away, I cannot say whether this be a frequent occurrence or not.

The urine is also various. Sometimes it is of a reddish or flame colour, which it preserves a long time; but it is oftener pale, and changes from time to time in colour as well as crudity, being sometimes clear, sometimes clouded: towards the end, upon a favourable crisis, it becomes thick, but does not always deposit a sediment.

If the sick lie warm, and have had no preceding flux, the body is generally bound; but when they lie cold, as they often do in field-hospitals, the pores of the skin being shut, a *diarrhœa* is a common symptom, but is not critical. In the worst cases, a flux appears in the last stage; then the stools are involuntary, colliquative, ichorous, or bloody, and have a cadaverous smell; the effects of a mortification of the bowels, and the sign of approaching death. When the hospitals are filled with dysenteries, some of the nurses will be infected

with the flux only, and others with this malignant fever, ending in these bloody and gangrenous stools. (124)

In the beginning, the heat is moderate; even in the advanced state, on first touching the skin, it seems inconsiderable; but upon feeling the pulse for some time, I have been sensible of an uncommon ardour, leaving an unpleasant sensation on my fingers, for a few minutes after.* The first time I observed this, I referred it to the force of imagination; but I was assured of the reality by repeated experiments, and by the testimony of others, who, without knowing of my observation, had made the same remark. A day or two before death, if care be not taken, the extremities become cold, and the pulse is then hardly to be felt.

The skin is generally dry and parched, though sometimes there are shorter or longer sweats, especially in the beginning. Such as are produced by medicine are of no use, except on the first attack, at which time they will often remove the fever; but such as are natural are never critical till the distemper begins to decline. These last are rarely profuse, but gentle, continued, and equally diffused over the body: sometimes the disease will terminate by an almost imperceptible moisture of the skin. The sweats are usually fœtid, and even offensive to the patient himself.

The tongue is mostly dry, and without constant care

(124) Another proof of the dysentery and hospital-fever originating from the same cause.

* Galen, describing the autumnal remitting fevers, makes the same remark about the heat: *Febrium, quæ a putredine oriuntur, maximum indicium est mordacitas et acrimonia caloris; quæ perinde ac fumus nares et oculos, sic ipsa credere tactum videtur. — Non statim ea qualitas, admota manu, discernitur, at per moram prædicta caliditatis species effertur ex penitioribus partibus.* Lacun. Epit. Galen. de Differ. Febr. lib. i. cap. vii.

of the nurse, becomes hard and brown, with deep chops: but this symptom is common to most fevers. It may be particular to this, that sometimes the tongue will be soft and moist to the last, but with a mixture of a greenish, or yellowish colour.(125) The drought is sometimes great, but more frequently moderate. In the advanced state, the breath is offensive, and a blackish furring gathers about the roots of the teeth.

Some are never delirious, but all are under a *stupor* or confusion. Few retain their senses till death; many lose them early, and from two causes; either from immoderate bleeding, or the premature use of warm and spirituous medicines. They rarely sleep, and, unless delirious, have more of a dejected and thoughtful look than what is commonly seen in other fevers. The face is late in acquiring either a ghastly, or a very morbid appearance; yet the eyes are always muddy, and generally the white is of a reddish cast, as if inflamed. The confusion of the head often rises to a *delirium*, especially at night; but unless by an unseasonable hot *regimen*, it seldom turns to rage, or to those high flights of imagination frequent in other fevers. When the *delirium* rises to that height, the face is flushed, the eyes are red, the voice becomes quick, and the patient struggles to get up. But when that disorder is owing to large evacuations, or only to the advanced state of the disease, the face appears meagre, the eye-lids in slumbers are only half shut, and the voice, which is commonly slow and low, sinks to a degree scarce to be heard. From the beginning, there is generally a great dejection of mind, and a failure of strength.

(125) We sometimes observe the tongue after being dry in this fever, suddenly to become moist, and yet the patient notwithstanding sinks under the disease.

A tremor of the hands is more common than a starting of the tendons; or if the *subsultus* occurs, it is in a lesser degree than in many other fevers. In every stage of the disease, as the pulse sinks, the *delirium* and *tremor* increase; and in proportion as the pulse rises, the head and spirits are relieved. Sometimes, even from the beginning, the patient grows dull of hearing, and at last becomes almost deaf.

When the fever is protracted, with a slow and low voice, the sick have a particular craving for something cordial; and nothing is so acceptable and so cordial as wine. They long for no food, yet willingly take a little panada if wine be added. But such as are delirious, with a quick voice, wild looks, a *subsultus tendinum*, or violent actions, though their pulse be sunk, yet bear neither hot medicines, wine, nor the common cordials.

Vomiting, and complaints of a load and sickness at the stomach, though usual symptoms, are not essential to the disease; nor are pleuritic stitches, difficulty in breathing, or flying pains to be referred to it, so much as to the constitution of the patient, or to a preceding cold.

There is a certain eruption, which is the frequent, but not inseparable attendant of the fever. This is a petechial efflorescence,* which is sometimes of a

* It is doubtful whether the ancients knew any thing of these spots, and the fever which they accompany; but among the moderns, they were, so far as I know, first described by Fracastorius, under the names of *Lenticulæ*, *Puncticula*, or *Peticulæ*; for by all these, both the fever and the spots were commonly called in his time. *Sunt et aliæ febres, quæ mediæ quodammodo sunt inter vere pestilentes et non pestilentes—quales illæ fuere quæ annis 1505, et 1528, in Italia primum apparuere ætate nostra non prius notæ, certis vero regionibus familiares; ut Cypro, et vicinis insulis, majoribus etiam nostris cognitæ, vulgus Lenticulas, aut*

brighter, or paler red, at other times of a livid colour, but never rises above the skin.* The spots are small, but generally so confluent, that at a little distance the skin appears only somewhat redder than ordinary, as if the colour were uniform; but upon a nearer inspection there are interstices seen. For the most part this eruption is so little conspicuous, that unless looked for attentively, it may escape notice. The spots appear thickest on the breast and the back, less on the legs and arms; and I do not remember to have observed any upon the face. I have sometimes seen them as early as the fourth, or fifth day, and at other times as late as the fourteenth. They are never critical, nor are they reckoned among the mortal symptoms, but only concur with other signs to ascertain the nature of the disease. The nearer they approach to a purple, the more they are to be dreaded. In a few cases, instead of spots, I have observed purple streaks and blotches, which perhaps are still a worse symptom. The *petechiæ* will sometimes not appear till after death;† and we had a case in the hospital, in which, upon bleeding, these spots were seen on the arm, below the ligature, and no where else on the skin.

This fever, though of the continued kind, yet has generally sensible exacerbations at night, with remissions and often partial sweats in the day; and after a

Puncticula appellat, quod maculas proferant lenticulis, aut puncturis pulicum similes. Quidam mutatis literis Peticulas dicunt. Fracast. de Morb. Contag. lib. ii. cap. vi.

* For this reason they are not to be referred to any of the *ecthymata* of the ancients, which denote pustules or eruptions higher than the skin, as in miliary fevers, with which this fever is not to be confounded.

† A circumstance incident to the plague. *Vid.* Diemerbroeck *de Peste, lib. iv. hist. v.*

long continuance, it is apt to change into a hectic, a remitting, or an intermitting form.

The length of the disease is uncertain: I have known it end either in death or recovery in seven days; but in the hospitals it generally continued from fourteen to twenty days;* and some died or recovered, after four weeks' illness. From the time of the sinking of the pulse till death, or a favourable crisis, there is perhaps less change to be seen from day to day in this, than in any other fever not of the malignant kind. When the course is long, it sometimes terminates in suppurations of the parotid,† or axillary glands; and when these do not appear, it is probable that the fever is kept up by the formation of some internal abscess. Many, after the crisis, complain of a pain in their limbs and want of rest; and almost all of them mention great weakness, confusion in their head, *vertigo*, and a noise in their ears.

Having now related the most distinguishing marks of this fever, I shall only add, that there are sometimes slight degrees of it hardly to be described, and which can only be discovered in full hospitals, by observing the men to languish, though the nature of the illness, for which they came in, should seem to admit of a speedier cure. In such cases, they have a whitish tongue, they complain of slight headachs, of want of appetite, and other inconsiderable feverish symptoms.

* Dr. Clephane observed, that the most sensible change to the better was generally upon the 17th day, from the time the patient found himself so ill as to keep his bed. The common period of the fever is the more diligently to be attended to, as we seldom have a crisis before that time, excepting upon a relapse, and then I have observed the course to be commonly shorter.

† I remember one instance of both parotids swelling, without any previous indisposition, when the person, not suspecting the

SECTION III.

Of the Prognostics.

MEN who have been weakened by distempers, or other accidents (as those who have undergone a salivation) are more susceptible of the infection than the strong and vigorous, and run more risk. Those who are taken into crowded hospitals, with the small-pox, however good the sort may be, and however well they may pass the height, fall readily into this fever, and die. One who has recovered is not less subject to a relapse, than he was to the distemper at first; but it has not been observed, whether such as have had abscesses are as liable to relapse as others. The second fever is attended with double danger, as the patient has been so much weakened by the first. A sure sign of the corruption of the air in an hospital, is, when many of the nurses fall sick.

We cannot draw a prognostic from any sign by itself, and all of them together are more fallible perhaps in these fevers than in others. Generally, the following are good: to have little *delirium*; the strength little impaired; turbid urine in the decline of the disease; and at that time, a gentle sweat or moisture diffused over the body; or even the skin soft, and the tongue moist; or to have then bilious stools succeeded by a *diaphoresis*; the pulse to rise by wine or cordials, with an abatement of the *stupor*, *tremor*, and other nervous symptoms. Deafness is rather a good sign. A sediment in the urine, without other changes to the

cause, and applying discutient cataplasms, was, upon the tumours subsiding, seized with the hospital-fever. This happened to Mr. Forbes, surgeon to the second troop of horse-guards, then a mate in the hospital.

better, is no sure mark of recovery; and some have recovered in whose water I had seen, no sediment.

The bad signs are, a *subsultus tendinum*; the eyes much inflamed and staring; the speech quick, and the sound of the voice altered; a high *delirium*; constant watchfulness; sickness at the stomach, and vomitings; frequent stools with a sinking pulse, and the disorder of the head increased; involuntary *faeces*; coldness of the extremities; and a tremulous motion of the tongue. It is observed to be among the worst signs, when the patient complains of blindness; when he swallows with difficulty; or cannot put out his tongue when desired to do it; when he can lie on his back only, and pulls up his knees; or when insensible, he endeavours to uncover his breast; or makes frequent attempts to get out of bed. If to any of these are added ichorous, cadaverous and involuntary stools, it is a sign of a mortification of the bowels and approaching death.

It will not seem strange to find most of these prognostics common to the advanced state of other fevers, when we consider, that from whatever cause fevers begin, by a long continuance the humours are corrupted, and the brain and nerves affected much in the same manner as in those which arise from infection.

SECTION IV.

Of the Dissections.

THE dissections of those who died of the common hospital-fever, or of Houghton's regiment, which had the distemper from the jails, were in all ten. In some of the bodies, all the cavities were opened; in others, either the brain alone was seen, or the bowels. These imperfections of this part I thought proper to mention, that the accounts here given might not be considered

as complete, or prevent others from pursuing the inquiry further.

The most unexpected appearances, were abscesses of the brain; of which therefore I shall take more particular notice. The first I saw of this kind was at Ghent; but the man being brought into the hospital from the barracks, no more than two days before he died, I could only conjecture from the symptoms, and the imperfect account I had of him, that his death was owing to a fever of this kind, after lingering near a month in it. I found about three ounces of purulent matter in the ventricles of his brain; and observed that the whole cortical and medullary substance was uncommonly flaccid and tender. Nay, some of the same kind of matter was found in the substance of the upper part of the *cerebellum*: yet this person, with some *stupor* and deafness, had his senses till the night before he died, so far at least, that he answered distinctly when roused and spoken to; but about that time the muscles of his face began to be convulsed.

Of two other instances of men, who undoubtedly died of this fever, in one the brain was suppurated; in the other, the *cerebellum*. In the former case, the patient was under a *stupor*, with deafness, from the beginning, but was never delirious, nor altogether insensible. His pulse sunk early; and about ten days before he died, his head began to swell, and continued very large till within two days of his death, when it subsided a little. For several days before his end he would taste nothing but cold water; and during his illness he lay constantly on his right side. The head being opened, an abscess as large as an egg was found in the substance of the fore part of the right hemisphere of the brain, full of thin matter like whey. At that time five more, ill of the same fever, had the like swelling of

their heads, but recovered.* This extraordinary symptom I never observed before nor since. In the other case, the abscess in the *cerebellum* was about the size of a small pigeon's egg, and contained also a thin ichorous matter: nor had this patient been ever so thoroughly insensible, as not to answer reasonably when spoken to. Two days before he died, his urine turned pale. Both these bodies were opened by Mr. Breach, apothecary in Southwark, then a mate in the hospital.

But suppurations in the brain were not constant; for another who died about this time, and had been ill about the same number of days, with the like symptoms, the pale water excepted, had no abscess either in the brain or *cerebellum*. And two were opened afterwards, in whom the cortical substance of the brain had an inflammatory appearance, but no suppuration. In one of them, the large intestines were corrupted: that man went off with a looseness; and just before his death he had a discharge of an ichorous matter from his nose. In the military hospital at Ipswich, one who unexpectedly died of this fever, after having been once in a fair way, had no suppuration in his brain. And about that time Dr. Clephane informed me, that he had seen the head of another opened, who died after an abscess in each of the orbits; that he had found the brain flaccid, and about two ounces of a thin *serum* in the ventricles; but that neither of these two bodies had been further inspected.

I shall not enter into a description of other particulars in these dissections; for though I have them written at length, it may be sufficient from what has been said to draw the following conclusions.

* This happened at Inverness, and all, or most of these men, were of Houghton's regiment. See page 42.

That, as there is the greatest tendency to putrefaction through the whole course of the illness; it generally terminates, when it proves fatal, either in an actual mortification of some part, or in an abscess of the brain, often ichorous; that the intestines more particularly are disposed to mortify, as few die without cadaverous and involuntary stools; and from an observation which we made, of the *petechiæ* not appearing till after death, it seems reasonable to conclude, that those spots are owing to a resolution and a corruption of the blood. The putrid sweats and smell of the body, before death, are a further argument for what is now advanced. And as to the abscesses, so often found in the brain, the ichorous kind may be considered as a species of mortification proper to parts of that texture; and from the preceding cases, it seems probable, that these suppurations are not rare occurrences in this fever.*

From the inflammatory appearance of the brain, without suppuration, we may account for the same remedies having sometimes opposite effects. For though in the advanced state, wine and cordials are often the best medicines, yet there are some who cannot take them without increasing the *delirium*: such therefore have probably some more than usual inflammation about the brain.

The last observation which I shall make upon the dissections, is, that the great tendency of this fever to putrefaction reduces it to the pestilential class of diseases; as all of that kind are remarkable for a prostration of strength, sunk pulse, dejection of spirits,

* From the numerous dissections of those who died of the last plague at Marseilles, it appeared that some of the *viscera* were always mortified and inflamed, and that the brain and lungs were most frequently affected in that manner. *Traité de la Peste*, part i.

putrid sweats and stools, *petechiæ*, livid blotches, and the like symptoms.

These are the inferences which we may reasonably draw from the dissection of the bodies. But from thence to ascertain the first morbid matter, where the effects only are seen; or to account for all the varieties of this fever, would be too great an attempt from such materials. Nor would it be just to propose our method of cure as deduced from the inspection of the dead bodies, since the most successful part of it was taken from the experience of others, or from trials of my own preceding most of these dissections.

SECTION V.

Of the Cure.

IN the cure of this fever, as in others, I varied my method according to the state of the disease. Distinguishing it therefore into three states, in each I shall propose those remedies which from experience I found to be the best. Let us suppose the first to continue as long as the person is able to go about; the second to begin with his confinement, when the fever is manifest, the head in some degree affected, but the pulse still full; and the third, when the pulse sinks, and a *stupor* comes on, with the other symptoms already described.

I. In the first state, as well as in all the rest, the fundamental part of the cure is to remove the patient out of the foul air. When that cannot be done, the room or ward is to be purified, by making a succession of air by means of fires, or letting it in by doors and windows, diffusing the steams of vinegar, or the like; for whatever medicines are given while the corruption of the air continues, or indeed increases by the *effluvia*

of the sick, there can be little hopes of recovery. Therefore in every stage, though the patient should breathe no other infectious air but that of his own atmosphere, it will be necessary if the bed has curtains, to keep them open, and use all other means to procure a free ventilation. On the strict observation of this rule, the cure will much depend.(126)

For the next article of prevention, I gave a vomit; and after its operation, half a drachm of *theriaca* with ten grains of *sal cornu cervi*, and some draughts of vinegar whey; and I repeated the same, without the vomit, the following night. Sometimes I have used the sudorific medicine alone; and by both methods I have seen those symptoms removed, which I apprehended to be the forerunner of this fever received by contagion.

I must not omit to observe, what may appear a minute circumstance, that as the prevention depended so much upon a free *diaphoresis*, I found it conducive to that end, especially with the less cleanly sort, to have their feet and hands washed with warm vinegar and water. After sweating, if the patient was to remain in the foul air, I used as a preservative a decoction of the bark and snake-root, which I shall treat of afterwards.

II. But in the second state, when the fever was manifest, if the pulse was full, I generally took away some blood, if that had not been done before.(127) When

(126) Besides elevating, or taking down curtains, the bed should be removed from the walls of a room, and when it can be done conveniently, placed in the middle of it. By this means the late Dr. Beardsley of Connecticut, checked the mortality of the dysentery in the American army, during the revolutionary war.

(127) There were now and then cases in which the loss of a few ounces of blood was found to be useful in the military hospitals of the United States.

the symptoms run high, a plentiful evacuation of this kind seemed indicated, yet I observed, that large bleedings generally proved fatal, by sinking the pulse and bringing on a *delirium*. Nor was a moderate bleeding to be repeated without caution; for as several circumstances in this fever were different from those of common fevers, so experience showed, that even those whose blood was sisy, unless their lungs were inflamed, were the worse for a second bleeding. If the head only suffered, I judged it safer to bleed by leeches at the temples, than to open a vein in the arm. But in the *delirium*, with a sunk pulse, even leeches did no good, sometimes, I imagined, did harm, and therefore phlebotomy was not to be tried. Many recovered without bleeding, but few who lost much blood.

Vomits are also to be used cautiously. Before the disease is formed, one was recommended for prevention; and even if the stomach was foul, as is usual in autumn, an emetic was believed to be proper in the beginning of the second period also, in order to relieve the stomach, and dispose to perspiration. In autumn 1757, when our troops returned from the expedition to the Rade de Basque, several of the soldiers were brought into the hospital, at Portsmouth, ill of a disorder compounded of the bilious and jail-fever. For when those men, upon being seized with the common fever of the season, were confined to the holds of the crowded transports, their distemper assumed a malignant form. All those who were not in the lowest state, but complained of a headach, of costiveness, and a disorder at their stomach, I first bled, then purged; and afterwards, proceeding with them in the manner described in the cure of the bilious fevers,* I gave them

* Page 179 et seq.

twice a day a grain of emetic tartar, which commonly not only puked, and opened the body, but brought on a *diaphoresis*. All those who were treated in this manner recovered. But in the advanced state of the hospital-fever, when the patient has all along complained of a sickness at his stomach, I judge emetics to be unsafe, from having, in two instances, seen the disease take suddenly a worse turn, when in that circumstance I had given a vomit of ipecacuanha. Nor can I recommend any other method as sufficiently ascertained by my experience for this symptom; but in other fevers, which I have treated since, and which, by a constant *nausea*, showed some similarity to this, I have frequently been able to conquer that complaint by giving the saline draughts of Riverius,† in the act of efferve-

† Huic symptomati (scil vomitui) gravissimo statim medetur, quasi miraculo, sal absinthii ad ℥i. in succi limonum recentis cochleari exhibitum, ut experientia didici. *River. in cap. de Feb. Pestilent.* The manner in which this operates may perhaps be deduced from the *Append. paper vii. exp. xlv.* I find the quantity, of a drachm of the salt, in Riverius's draught, marked in two editions of the original; but which must be a typographical error for a scruple, if the author meant there should be no more salt than is sufficient to saturate the acid, and if the salt which he used was of the same strength with ours. This last circumstance however may be doubted, considering that formerly the *sal absinthii* was frequently prepared with sulphur, and by means of the acid there, it became a much weaker alkali than that which is now kept in the shops. In those days recourse was had to this salt, in several disorders of the stomach, from a notion that it possessed the virtues of the original plant; and the acid seems chiefly to have been added to make it more grateful to the stomach. But now we find, that the lixivial salt of every plant will answer as well as that of wormwood; and that the lemon-juice, or some other acid is necessary for producing an effervescence, with an evolution of some fixed air, upon which the virtue of that medicine so much depends. *See Append. paper vii. exp. xlv.*

scence, but repeated oftener than what is commonly practised by others. This is my *formula*:

℞ *Salis absinthii* ℥iv. *sacchari albi* ℥ij. *solve ex aquæ puræ* ℥iv.
et admisce aquæ cinnamomi simplicis ℥ij.

Dentur omni hora cochlearia iij. cum cochleari uno succi limo-
num, donec æger nauseare desierit.

Previously to this medicine, I have sometimes made the patient clear his stomach by drinking some camomile-tea; at other times, I have omitted that infusion; but, when costive, I have generally begun with a laxative clyster, and caused it to be repeated every day, or frequently, if the patient had not otherwise stools.

My next care was to promote a perspiration, which in this state of the fever, was only attempted by the cooler diaphoretics; and for that purpose the *spiritus Mindereri* was chiefly used. But at this time of the disease, the morbid cause was generally too much fixed to be expelled by the pores of the skin; and therefore unless a sweat came easily, and with relief to the patient, it was never insisted on; nay, if voluntary and profuse, with a low and quick pulse, I judged it proper to check it. Then the fever began to elude the force of blisters, alexipharmacs, and sudorifics, until the usual time of its decline. Of this I have seen many instances, but shall only mention one: Mr. Annesly, one of the mates, was seized with the hospital-fever, and after being confined to his bed, for four or five days, and blistered, he took several doses of musk, of five and twenty grains each, which opened his body, raised his pulse, and brought out a thorough sweat; yet the fever continued till about the seventeenth day, and then went off with a gentle moisture of the skin, and turbid urine. (128)

(128) The hospital fever in spite of the power of medicine will run its protracted course. Sweats, whether natural or obtained

As soon therefore as the fever was confirmed, I gave such medicines only as were recommended above, in the cure of inflammatory fevers,* *viz.* the contrayerva-powders with nitre and camphire, and barley-water acidulated with vinegar.

Although costiveness was prevented by clysters (lest an accumulation of the *faeces* should prove a new *fomes* of corruption) yet a looseness was not encouraged, on account of the great weakness attending this illness.

About this time I have used blisters, but without success. Nay, upon the first attack, the whole head has been blistered, and the oozing kept up for some days; but without relieving the head, or preventing any of the usual symptoms.

III. I come now to the third, and longest state, in which the pulse sinks, the *stupor* is great, a *delirium* is threatened, and *petechiæ* often appear. This change begins in three or four days after the fever is formed, often later, according to the treatment and other circumstances. But, what is observable, if the patient has been once or twice largely bled, on the first symptoms, he will sometimes pass over the second stage, and from a condition little removed from health, his pulse will be apt to sink, and he suddenly become delirious. Now, whether this change was occasioned by misconduct, or came in the course of the disease, I found it necessary to vary the method, and to have for

by art, generally do harm not only during its course, but at its crisis. It is strange, that physicians who very properly object to bleeding in this typhus state of fever, should forget that sweating is another and more unsafe mode of depleting in it. Those recoveries are most certain in which the fever terminates in a general moisture or softness of the skin.

* Part iii. ch. i.

my principal intention, the support of the *vis vitæ*, especially towards the decline of the fever; but which could not be answered without some warmer medicines than those which have yet been mentioned. Therefore as soon as the pulse began to sink, and the urine to turn pale, I left out the nitre in the diaphoretic powders,* and substituted 10 grains of the *radix serpentariæ Virginianæ*.

Sometimes I have given a plain decoction of that root, adding a small quantity of some spirituous liquor; at other times, I have prescribed the same in substance, from two scruples to a drachm every day, and with good effects; but at last an accident was the occasion of my adding the bark. A man ill of this fever, with petechial spots, having a blister applied to his back, the part mortified; but a strong decoction of the bark, together with some of the tincture being given, and continued for some days, with the usual cordials, the sore began to suppurate, and the case took so favourable a turn, that there was little doubt of the patient's recovery, till nauseating the medicine, he left it off, and then the gangrene recurring he died. From this case however, I was induced to join the decoction of the bark to the snake-root in the advanced and sunk state of the fever. The first nine recovered who took this compound medicine, though four of them had the *petechiæ*; and of thirty-nine cases, which were under my care during that season, I lost only four. But it will be just to add, that the places in which the sick lay were uncommonly well aired, and that the fever was not attended with such bad symptoms as I have seen at other times. For at Ipswich, where the kind was worse, and where the air was so much vi-

* Part iii. ch. i.

tiated in the hospital, that most of the nurses were infected, as well as the men who were admitted for other distempers, I imagine (for I kept no exact account) that I might lose about double that proportion.

When I joined the bark to the *serpentaria* in ordinary cases, I began with a much smaller quantity of the former than what I had used for the gangrene, intending to increase it by degrees; but finding that smaller quantity answer so well, I seldom altered it. This is now my receipt:

R *Corticis Peruviani in pulverem contriti* ℥iij. *coque ex aquæ fontanæ* ℥xvj. *ad* ℥viiij. *adjectis sub finem coctionis radicis serpentariæ Virginianæ contusæ* ℥ij. *stent per horam, dein colaturæ admisce aquæ alexiteriæ spirituosa cum aceto* ℥ij. *sacchari albi* ℥β.

Of this my common dose was four spoonfuls every six hours; but if the patient seemed to be heated by it, he took only three. If he was lower than usual I gave the larger quantity once in four hours; thus giving the medicine at shorter or longer intervals, according to the circumstances: sometimes I have lessened the proportion of the *serpentaria* when I imagined it heated too much.

In one case the fever terminated in a suppuration of one of the parotids, which was opened and healed during the use of the same remedy.

Besides this medicine, I found it sometimes proper to give a volatile cordial, in this manner:

R *Aquæ fontanæ* ℥vj. *aquæ nucis moschatæ* ℥j. *confectionis cardiace* ℥iβ. *salis cornu cervi* ℥β. *syrupi croci* ℥β. *misce.*
Dentur subinde in languoribus cochlearia ij. *vel* iij.

This quantity was commonly consumed in 24 hours. But in cases out of the hospital, and where wine was to be had in plenty, I either omitted this mixture, or used it more sparingly. In general, it agreed well with the low state of these fevers; and in great sinkings,

which either came after unseasonable bleedings, or long want of nourishment, it was, next to wine, the best resource. For, as a grateful and efficacious cordial at this time, there was nothing comparable to wine, of which the common men had an allowance from a quarter to half a pint in a day, of a strong kind, made into whey, or added to panada, which was their only food. But to others out of the hospital, I commonly prescribed Rhenish, or a small French wine, whereof some have consumed near a quart a day, and part of that undiluted. And indeed so great is the virtue of wine in this stage of the fever, that I have known several recover from the lowest condition, when refusing the decoction, on account of its taste, they took nothing but a little panada with wine, and the volatile mixture, every two or three hours, by turns. Perhaps there is no rule more necessary, than not to let the patient, when low, remain long without taking something cordial or nourishing; as I have seen men, once in a promising condition, sunk past recovery, by being suffered to pass a whole night without any support, about the time of the crisis. In the advanced state of this fever, the sick are remarkably low, and therefore Hoffman rightly advises, in such cases, that they should be kept constantly in bed, and not permitted even to sit up in it. In the last stage of this disease, as well as in that of the sea-scurvy, it should seem, that the force of the heart is too small to convey the blood to the brain, except when the body is in an horizontal posture.*(129)

* See the description of the sea-scurvy in Lord Anson's voyage.

(129) Many soldiers perished with this fever in the military hospitals of the United States during the revolutionary war from passing whole nights without food or drink, and some of them fell dead in attempting to walk to or from a close stool. Opium

But however necessary wine, and the decoction above mentioned, are in the low state of the fever, we are to remember, that throughout this long stage, these remedies are to be administered only as antiseptics, and supporters of the *vis vitæ*; without aiming at thoroughly raising the pulse, or thoroughly relieving the head, or at forcing a sweat by them, before nature points that way; which I have seldom seen happen before the fourteenth day. For though the patient may die before that period, if he has been largely bled, or if the cordial medicines have been given him too freely, yet such remedies as I have used have not been powerful enough to bring on a crisis sooner.

We have seen how inseparable a *stupor* was from this fever, particularly in its low state, and how apt this *stupor* was to turn to a slight *delirium* in the evening. If this was all, as being in the common course, nothing was done. But if the *delirium* increased upon using wine, if the eyes looked wild, or the voice became quick, there was reason to apprehend a *phrenitis*; and accordingly I have often observed, that at such times all internal heating medicines aggravated the symptoms; whilst blisters, before useless, became then of service: in those circumstances therefore, I began to apply them as in the inflammatory fevers. I have had no opportunity of trying, in the *delirium* of these fevers, the fomentations of warm water and vinegar for the feet, which since the war I found efficacious in other fevers;* but I am inclined to believe, that in this case also, they would answer better than either sinapisms or blisters, provided they be long enough and often enough applied. In the inflamma-

in frequent, and sometimes in large doses, was more useful than wine in many instances in the low state of the fever in the American military hospitals.

* Part iii. ch. ii. § 1.

tory fevers, I have known these fomentations have little effect for the first hour, and yet succeed afterwards. For internal medicine, I omitted the decoction for some time, but continued the acid drink,* and gave camphire with the *pulvis contrayervæ compositus* and nitre, as before. If the *delirium* was with a slow voice, and without violent motions, the decoction, and wine were given, without any other medicine; for in no instance was this symptom quite removed till the usual time of the crisis. I have observed that a *delirium* would arise from two opposite errors; one, from large and repeated bleedings; and the other, from wine and the cordial medicines being given too early. It appears therefore how nice the principles are that regard the cure: thus neither a hot, nor a cool regimen, will answer with every patient, nor with every state of the disease.(130)

If a *diarrhœa* came on in the decline of the fever, it was moderated (but not suppressed) by adding a few drops of the *tinctura Thebaica* to the full quantity of the alexipharmac decoction; or by giving some spoonfuls of the chalk-julep with opium, mentioned before.† For though the looseness may be considered as critical, yet as the sick are too low to bear great evacuations, it must in some measure be restrained; and I have often observed, that when it has been treated in this manner, about the usual time of the crisis, the patient has fallen into a breathing sweat, which has carried

* *Viz.* Barley-water with vinegar.

(130) It is equally true, delirium may be cured by the opposite remedies of depletion, and stimulants, according to the state of the system.

† Page 185. In order to check the purging and promote a *diaphoresis*, I should now prefer the bolus of theriaca with ipecacuanha, likewise mentioned in that page.

off the disease. In the worst cases of this fever, and especially when it coincides with the dysentery, the stools are frequently bloody; in which dangerous state if any thing could be done, it was attempted by the same medicines. In proportion to the putrid nature of the stools, opiates and astringents were used with the greater caution.

We shall next consider the state of the patient after the fever has ceased, or changed into another form. If the disease terminates in a suppuration of the parotid glands, we are to open the abscess, without waiting for a fluctuation, or a thorough softness of the tumour, which may never happen; the *pus* being often here so viscid, that after it is ripe, the part will feel nearly as hard as if the suppuration had not begun.*

Almost every patient, after the fever, complained of want of rest, frequently of a *vertigo*, or confusion of the head, of a continuation of the deafness, or other symptoms, which are commonly called nervous. I then gave an opiate at night, and in the day, some strengthening medicines, such as the bark, and the elixir of vitriol. I found that in these cases the bark was not only the best strengthener but the surest preservative against a return of the fever. For this last intention, I gave the convalescent about three drachms a day, for six or seven days together; and afterwards, if he remained longer in the hospital, some smaller quantity daily. When the pulse was slow, a few grains of *asa-*

* This may be the reason why these tumours have not always proved critical. For Riverius, after the swelling of the glands, was obliged to make other evacuations, perhaps from not making timely incisions. *Vid. cap. de Feb. Pestilent.* Mr. Girle, formerly surgeon at St. Thomas's, observed to me, that such critical tumours, after malignant fevers, were not to be ripened by poultices of bread and milk (which by growing cold are more apt to repel them) but by some of the warm gum-plasters.

foetida, given twice a day, have had a good effect. But if there was any appearance of a hectic fever, from an inward abscess, the case was treated accordingly. Upon comparing some of the remaining symptoms of those who recovered, with the condition of the brain in such as died, and were opened, I have been induced to think, that some part even of that substance might suppurate, and yet the person recover.

Sometimes the patient falls into an irregular intermittent, which, if not of a hectic nature, from an internal abscess, may proceed from neglecting to clear the *primæ viæ*. For it is easy to conceive, that after a long fever of so putrid a nature, often attended with a languor of the bowels, the *feces* may be so much accumulated, and so corrupted, as to occasion new disorders. In such circumstances, after proper evacuation by a purge, the bark was almost a sure remedy.

SECTION VI.

Of the Causes of Malignant or Pestilential Fevers.

IT is evident from the preceding account, that this distemper is of a truly pestilential nature; as appears by the manner in which the head is affected, by the dejection of the spirits, debility, sunk pulse, the supuration of the parotid and axillary glands, the putrid sweats, petechial spots, mortifications, and contagion. For though all these symptoms are not found together in one person, yet they are common to the disease; and it is well known that in the plague itself, the symptoms are various, according to the degree of virulence, and the constitution of the person infected.

It would be unnecessary to show the difference between a malignant or pestilential fever, and the true plague, as that distinction, perhaps not clearly comprehended by the ancients, has been well ascertained by some of the later writers on that subject: and there-

fore I shall only remark, that though the hospital-fever may differ *in specie* from the true plague, yet it may be accounted of the same *genus*; as it seems to proceed from a like cause, and is attended with similar symptoms.(131)

The malignant or pestilential fevers are various, according to the virulence of the *miasma* or putrid ferment received into the blood; but all seem to depend upon some internal or external *fomes* of corruption, whether owing to a putrid habit, or to exhalations from corrupted animal, or vegetable substances. I shall first treat of the remote and external causes, and next of the internal and immediate.

I. The hospital and jail-fever are to be considered as the same disease, and little, if at all, different from such as have arisen after battles, when the bodies of the slain have been left unburied to rot upon the field. This Galen notes as one of the causes of pestilential fevers,* and is supported by the testimony of other authors, in particular by Forestus, who was eyewitness to a distemper of this kind (which indeed he calls a plague) owing to the same cause, attended with buboes and a high degree of contagion.† The same author also gives an account of a malignant fever breaking out at Egmont in North Holland, occasioned by the rotting of a whale, that had been left upon the shore.‡ We have a like observation of a fever affecting

(131) The editor dissents from the author in supposing the plague to arise from idiomiasmatic exhalations. It is produced by the same exhalations as bilious fevers. In small and filthy huts both kinds of exhalation may combine, in which case it is probable the plague may become contagious, but in a very feeble and limited degree.

* Epit. Galen. De Feb. Differ. lib. i. cap. iv.

† Observat. lib. vi. obs. xxvi.

‡ *Obs. ix. schol.* Paræus observes, that in his time the like happened on the coast of Tuscany. *De Peste. cap. iii.*

the crew of a French ship, upon the putrefaction of some cattle, which they had killed in the island of Nevis in the West-Indies†. These men were seized with a pain in their head and loins, great weakness, and a disorder of the stomach, accompanied with a fever; some had carbuncles; and on others, purple spots appeared after death.

Hippocrates describes a pestilential constitution, and imputes it to a southern, humid and close state of the air‡. The putrid *effluvia* of lakes and marshes are mentioned by Galen as having the same effect.§

One of the most memorable distempers incident to an army is recorded by Diodorus, the historian,|| which broke out among the Carthaginians, in Sicily, at the siege of Syracuse. That author not only relates some of the most distinguishing symptoms, but reasons well about the cause. He observes, that pains in the back, and eruptions¶ were common; that some had bloody stools; and that others were suddenly seized with a *delirium*, so as to run about and beat all that came in their way;** that they died on the fifth, or at furthest on the sixth day; that the physicians knew no cure; and that it was the more fatal as the sick were abandoned by every body, on account of the contagion. As to the cause, the author takes notice, of the multitude of people confined within a narrow compass; of the situation of the camp, in a low and wet ground; of the scorching heats in the middle of the day, succeeded by the cold and damp air from the marshes in

† *Traité de la Peste.*

‡ *Epidem. lib. iii. sect. iii.*

§ *Epit. Galen. de Feb. Differ. lib. i. cap. iv.*

|| *Biblioth. Hist. lib. xiv. cap. lxx. lxxi.*

¶ In the original, *φλύκταιναι.*

** This circumstance of a sudden *delirium* agrees with what was mentioned in the description of the marsh-fever, in the cantonments near Bois-le-duc. *Part iii. ch. iv. § 2.*

the night-time:* he adds, the putrid steams arising first from the marshes, and afterwards from the bodies of those who lay unburied.

I observed, that I had found the first full account of malignant epidemic fevers, attended with *petechiæ*, in Fracastorius. One of those appeared in the year 1505; another, three and twenty years after, and both in Italy. That author omits the cause of the former; but the latter he ascribes to an extraordinary inundation of the Po, which happening in the spring left marshes, and these corrupting infected the air throughout the summer.

Forestus remarks, that from the putrefaction of the water only, the city of Delft, where he practised, was scarce ten years together free from the plague, or some pestilential distemper.† In the year 1694, a fever broke out at Rochfort in France, which, on account of the malignant symptoms and great mortality, was at first believed to be the true plague.‡ But M. Chirac, who was sent by the court to inquire into its nature, found the cause to arise from some marshes that had been made by an inundation of the sea; and observed, that the corrupted steams, which smelled like gun-powder, were carried to the town by the wind, that had long blown from that quarter. About two thirds of those who were taken ill died.§ This fever raged in

* This is said to be the principal cause of the malignant camp-diseases in Hungary. See pages 168, 169.

† *Observat. lib. vi.* He adds, that the magistrates, upon his representation of the cause, erected a wind-mill for moving and refreshing the water. At that time Holland was more liable to inundations, and to the stagnation of water, than at present.

‡ *Traité des Fievres Malignes. Oeuvres Posthumes de M. Chirax. Eloge de M. Chirax par M. de Fontenelle.*

§ In those who were opened, the brain was found either inflamed, or loaded with blood; the fibres of the body were remarkably tender, and the bowels were either suppurated, or mortified.

June, July, and August, and then ended upon a great fall of rain; which purified the air, and refreshed the stagnating water.

I might adduce many instances of malignant fevers, occasioned by the putrid *effluvia* of marshes, from other authors; but as these already mentioned seem sufficient to prove what has been advanced, I shall observe upon the whole, that the bilious or remitting, and intermitting fever of low and wet countries, when at the worst, may be considered as a species of the malignant or pestilential fever; since they have been seen with all the virulent symptoms peculiar to that class of diseases.*

In general, it may be remarked, that the putrefaction of animal or vegetable substances, in a dry air, is most apt to produce a malignant fever of a more continued form; whereas putrid *effluvia*, in a moist atmosphere, have a greater tendency to bring on paroxysms and remissions. But the steams of corrupted blood seem to dispose more to a flux than to any other disorder; for though some will be seized with the hospital-fever by the contagion of bloody stools, yet I have observed, that for the most part this infection produces the dysentery.†

From this view of the causes of malignant fevers and fluxes, it is easy to conceive how incident they must be, not only to all marshy countries after hot seasons, but to all populous cities, low and ill aired; unprovided with common sewers; or where the streets are narrow and foul; or the houses dirty; where fresh water is scarce; where jails and hospitals are crowded, and not ventilated, or kept clean; when in sickly times, the burials are within the walls,‡ and the bodies not laid deep; when slaughter-houses are likewise within

*Part iii. ch. iv. § 2, 3. † Part iii. ch. vi. § 3.

‡ *Secreta de Feb. Castrens. Malign.*

the walls; or when dead animals and offals are left to rot in the kennels, or on dunghills; when drains are not provided to carry off any large body of stagnating or corrupted water in the neighbourhood; when flesh meats make the greatest part of the diet, without a proper mixture of bread, greens, wine or other fermented liquors; when the grain is old and mouldy, or has been damaged by a wet season; or when the fibres are relaxed by immoderate warm bathing. I say, in proportion to the number of these or the like causes concurring, a city will be more or less subject to pestilential diseases, or to receive the leven of a true plague, when brought into it by any merchandize. I shall add a few instances to confirm these observations.

Constantinople is not only liable to frequent returns of the true plague, but to an annual pestilential fever, which may be considered as the endemic distemper of that place.* But, that this is not owing to the climate, appears from its healthful state during the Greek empire, and from observing, that even now, such as live in the suburbs, and keep out of the way of infection, are secure. Nor is the cause to be referred only to the crowds, and to the narrowness and nastiness of the streets; since some of the foreigners are less subject to the sickness than the Turks themselves.† It must therefore be attributed to something peculiar to that people, or rather to such as profess their religion. For, besides that pestilential distempers are frequent in all the cities of the Levant, they prevail in Egypt;‡ where

* See Timoni's account of the plague at Constantinople. *Phil. Trans.* n. 364. *Abridg.* vol. vi. part iii. ch. ii. sec. xxi.

† Although Timoni observes that strangers in general run a greater hazard than the citizen, yet he adds, Armeni omnium nationum minime ad pestem sunt dispositi: observo illos paucissimis uti carnibus; cepis, porris, alliis, vinoque maxime utuntur.

‡ Vid. Prosp. Alpin. de Med. Ægypt.

the inundations are not solely to be blamed; as that country was more healthful before it became a province of the Ottoman empire. And in Sennar, where Mahometanism is likewise established, pestilential fevers are destructive; though they seldom visit the Abyssinians, who border on that kingdom, and live in a hotter climate, but are Christians.* Now, for this difference, the following causes may be assigned. The religion of the Turks enjoins constant ablutions; their luxury is in their baths; and it is well known how much warm bathing; by relaxing the fibres, may dispose the body to putrid diseases.† Add to this, their abstinence from wine and all fermented liquors, the great antidotes to putrefaction;‡ the principle of fatalism, which keeps them from avoiding infection; and their ignorance of the learned arts, by which they might know to prevent or cure the plague.

In the account of the epidemic malignant fever of Cork, we find the cause ascribed by the author to a concurrence of these circumstances: the moisture of the air, the impurity of the water, the infection of an uncommon number of slaughter-houses, and the offals left to corrupt in the streets; joined to the immoderate quantity of flesh-meats, eaten by the poorest people,

* Lettres Edifiantes et Curieuses, recueil iv.

† Therefore Celsus forbids bathing in time of the *pestilentia*; that is, as was shown before, during the season in which malignant or pestilential fevers prevail. *De Med.* lib. 1. cap. x.

‡ We have the following singular observation in Forestus, on occasion of a pestilential fever that raged in his time: Quicumque aquam obingentem calorem febrilem bibissent (ut villicus quidam, ad quem curandum alio morbo affectum, accitus essem, mihi narravit) correpti intra duos dies moriebantur. Qui vero cerevisiam bibebant, utpote potum magis huic nostræ regioni consuetum, iis morbus protrahebatur. Dr. Rogers observes, that "such as riot on animal food, and drink water only, are subject to putrid and slow fevers."

without bread or fermented liquors, during the victualing season.*

Forestus informs us of a pestilential fever, which raged at Venice in his time, produced by the corruption of a small kind of fish in that part of the Adriatic.† (132) And the same author quotes Montanus for a description of the pestilential endemic fever at Famagusta, in Cyprus, arising, in summer, from the corruption of a lake in the neighbourhood of that city. This very distemper we find taken notice of by Fracastorius, and allowed to be the same with what he calls the *lenticulæ* or *puncticula*, since known by the name of the petechial fever.

History abounds with examples of pestilential fevers added to the other miseries of a siege; nay there is scarce any instance of a town being long invested, without some distemper of this kind. Sometimes it may be owing to the filth of a place, crowded with people, and cattle, brought in for shelter, as it formerly happened both at Athens‡ and at Rome;§ at other times the sickness has been occasioned by corrupted grain;|| and by meats long salted, becoming putrid.

Although the putrefaction of vegetables is not so

* See Dr. Rogers's Essay on Epidemic Diseases. In this book we have a full account of the rise of a malignant fever and small-pox, deduced from a putrefaction in the air, peculiar to the city of Cork, from August to January. That place is noted for the great number of cattle killed for the use of the shipping, which is said to amount to above 120,000 head in the year.

† Observat. lib. vi. obs. ix. schol.

(132) The first cases of yellow fever which occurred in New-York in the year 1798 were induced by the effluvia of some salted beef in a state of putrefaction.

‡ Diodor. Biblioth. Hist. lib. xii. cap. xlv.

§ Tit. Liv. anno U. C. ccxci.

|| Cæsar de Bell. Civ. lib. ii. viz. in his account of the siege of Marseilles.

noxious as that of animals, it is not however without bad effects; for vegetables rotting in a close place yield a cadaverous smell; and we have instances of malignant fevers occasioned by the *effluvia* of putrid cabbages,* as well as of plants in marshes. (133) Forestus imputes the plague at Delft, in the year 1557, to the eating of mouldy grain, which had been long kept up by the merchants, in a time of scarcity.† And I have heard it remarked, that in this island the dysentery is observed to be more frequent among the common people, in those parts where they live mostly on grain, when the preceding crop has been damaged in a rainy season, or kept in damp granaries.

Jails have been often the cause of malignant fevers; and perhaps no where oftener than in this country. Lord Bacon makes the following observation: “The most pernicious infection, next the plague, is the smell of the jail, when the prisoners have been long, and close, and nastily kept; whereof we have had, in our time, experience twice or thrice; when both the judges that sat upon the jail,‡ and numbers of those who attended the business, or were present, sickened upon it and died. Therefore it were good wisdom, that in such cases the jail were aired before they be brought forth.”§ It is probable that one of the times, pointed at by this noble author, was at the fatal assizes held in the year 1577; of which we have a more particular account in Stowe’s Chronicle, in these words: “On the 4th, 5th and 6th days of July were the assizes held at Oxon, where was arraigned and

* Dr. Rogers’s Essay on Epidemic Diseases, p. 41.

(135) Putrid vegetables more uniformly induce bilious fevers, than putrid animal substances.

† Observat. lib. vi. obs. ix.

‡ That is, upon the prisoners from the jail.

§ Nat. Hist. exp. dccccxiv.

“condemned Rowland Jenkins for a seditious tongue; at which time there arose amidst the people such a damp,* that almost all were smothered. Very few escaped that were not taken. Here died in Oxon three hundred persons; and sickened there, but died in other places, two hundred and odd.”†

Of the same kind of infection, we have an unhappy instance, so fresh in our memory, that I needed not to have mentioned it here, had it not been to inform such as live at a distance, or those who are to come after us. In the year 1750, on the 11th of May, the sessions began at the Old-Bailey, and continued for some days; in which time there were more criminals tried, and a greater multitude was present in the court than usual. The hall in the Old-Bailey is a room of only about thirty feet square. Now, whether the air was most tainted from the bar by some of the prisoners, then ill of the jail-distemper, or by the general uncleanness of such persons, is uncertain;§ but it is probable that both causes concurred. And we may easily conceive, how much it might have been vitiated by the foul steams of the Bail-dock, and of the two rooms opening into the court, in which the prisoners were the whole day crowded together till they were brought out to be tried.|| It appeared afterwards that those

* *A damp*, an old expression (still retained by the miners) signifying *bad air*.

† This account is confirmed by Camden. *Annal. Elizabeth.*

§ It has been the custom, some days before every sessions, to remove all the malefactors from the other jails into that of New-gate, already too much crowded. At such times three hundred have been confined within that narrow space; and it is well known how nastily both this and other prisons here are kept.

|| I have been informed, that at those sessions about a hundred were tried, who were all kept in those close places as long as the court sat; and that each room was but 14 feet by 11, and 7 feet high. The Bail-dock is also a small room taken off one of the corners of the court, and left open at the top: in this, during the

places had not been cleaned for some years. The poisonous quality of the air was aggravated by the heat and closeness of the court, and by the perspirable matter of a number of people of all sorts, penned up for the most part of the day, without breathing the free air, or receiving any refreshment. The bench consisted of six persons,* whereof four died, together with two or three of the counsel, one of the under-sheriffs, several of the Middlesex-jury, and others present, to the amount of above forty; without making allowance for those of a lower rank, whose death may not have been heard of; and without including any that did not sicken within a fortnight after the sessions.

trials, are put some of the malefactors who have been under the closest confinement.

* *Viz.* the Lord Mayor, three of the Judges, one of the Aldermen, and the Recorder. Of these died Sir Samuel Pennant, Lord Mayor; Sir Thomas Abney and Baron Clarke, Judges; and Sir Daniel Lambert, Alderman. It is remarkable, that the Lord Chief-Justice and the Recorder, who sat on the Lord Mayor's right hand, escaped, whilst he himself, with the rest of the bench, on his left, were seized with the infection; that the Middlesex-jury, on the left side of the court, lost many, whilst the London-jury, opposite to them, received no harm; and that of the whole multitude, but one or two, or, at most, a small number of those who were on the Lord Mayor's right hand, were taken ill. Some, unacquainted with the dangerous nature of putrid *effluvia*, have ascribed both this circumstance, and the sickness, in general, to a cold taken by opening a window; by which a stream of air was directed to the side of the court on the Lord Mayor's left hand. But it is to be observed, that the window was at the furthest end of the room from the bench, though the Judges suffered most. Nor could the kind of the fever, nor the mortality attending it, be attributed to a cold: it is therefore probable that the air from the window directed the putrid steams to that part of the court above mentioned. Indeed it must be granted, that septic particles, passing into the blood, become more active and fatal if the infected person catches cold, or by any accident suffers a stoppage of perspiration; for a free perspiration seems to be the chief means by which the blood is purified from any infectious matter.

It was said, that this fever in the beginning had an inflammatory appearance, but that after large evacuations the pulse sunk,* and was not to be raised by blisters, nor cordials; and the patients soon became delirious. Several had *petechiæ*; and all that were seized with the fever died, excepting two, or three at most. Some escaped without a fever, by a looseness coming on, which was easily cured. This sickness, as far as was known, spread no further; there being at that time no disposition in the air, nor other circumstances, to propagate the infection.

By Dr. Huxham's observations, we find that the same kind of fever had been frequent at Plymouth during the former war, occasioned by the number of French prisoners, and by the hospitals and other places being crowded with men, taken out of our own ships, actually ill of the distemper.†

It is remarkable how much the plague, pestilential fevers, putrid scurvies and dysenteries, have abated in Europe within this last century; a blessing which we can ascribe to no other second cause, than to our improvement in every thing relating to cleanliness, and to the more general use of antiseptics. Felix Platerus, physician at Basil in Switzerland, gives an account of seven different pestilential fevers (he calls each *pestis*) which afflicted that city in the space of seventy years, all of them within his memory.‡ Thomas Bartholine mentions five that raged in Denmark in his time; and all from some foreign contagion.§ And other authors, their contemporaries, throughout Europe, are full of the like observations. Forestus remarks, that in his

* See page 258. † Essay on Fevers, ch. v. viii.

‡ F. Plater. Observa. lib. ii.

§ Nostra memoria quinquies in Dania pestilentia grassata est, 1619, 1625, 1629, 1637, 1654, semper aliunde translata. Tho. Barthol. de Medicin. Danor. Domest. dissert. iv.

days the plague was most frequent at Cologne and Paris; and refers the cause to the multitude of the inhabitants, and the nastiness of the streets;* yet both those cities are at present healthful, and not peculiarly subject to any putrid disease. Timoni takes notice, that at Constantinople the cleaner houses are less liable to be infected with the plague than the dirty.†

As to diet, it may be observed, that hopped beer, wine, and vinous liquors, coming more into general use, have been some means of suppressing putrid diseases. Greens and fruit are likewise more universally eaten;‡ and salted meats make a much less part of our

* *Coloniæ, et Lutetiæ Parisiorum, pestis frequentissima est ob hominum frequentiam et sorditiem platearum. Observat. lib. vi. obs. v. schol.* At that time, the streets not being paved, we may easily conceive how offensive they must have been in such large and populous cities. It will be proper to observe, that Forestus generally confounds the true plague with pestilential or malignant fevers, and therefore it is probable that he only means the latter; since those two cities have been little liable to the true plague, from their inland situation.

† *Philos. Transact. n. 364. Abridg. vol. vi. part iii. ch. ii. sect. xxi.*

‡ Having asked Mr. Miller, keeper of the botanic garden at Chelsea, what he thought might be the proportion between the quantity of greens and fruit consumed now, and a hundred years ago, he answered: "That in former times, he believed, the tradesmen and common people, about this city, scarce used any, and those of higher rank, but little. For that he had been assured by old gardeners, and by others of his acquaintance, that so late as seventy years ago, a cabbage sold at three-pence, which now sells for a half-penny; and that most other greens and fruit were proportionally dear; insomuch that those, who now eat garden-vegetables every day, would then only use them on Sundays, by way of dainty. From which circumstance, and the present extent of ground laid out in kitchen-gardens, he inferred, that there was at least six times more garden-stuff used now than about the time of the revolution." Nor are we to think that this defect of greens and fruit was supplied by a greater consumption of the *farinacea* in bread, or in other forms; since at that

diet than formerly. (134) To this, add the more general consumption of tea and sugar, which I have shown elsewhere to be no inconsiderable antiseptics.* How far these things may be abused, or become productive of other distempers, is not now the question.

For so great a city, perhaps London at present is one of the least subject to pestilential fevers, to the dysentery, or other putrid diseases; with which however it seems formerly to have been little less infested than others, notwithstanding the advantages of its situation; *viz.* in a climate not liable to great heats, or close weather; on a gravelly soil; and on the banks of a large river, which not only supplies fresh water, but fresh air, by the constant motion of the tides. Add, that London stands in a wide plain, where the fields are kept pretty open. Even since the days of Sydenham, there appears to be a considerable alteration for the better; for besides that there has been no plague, we have known no malignant epidemic fever, or fatal dy-

time bread was dearer in proportion to meat than it is now. Hence it seems reasonable to conclude, that formerly a greater quantity of flesh was eaten than at present; and it is well known how much more salted meats were then in common use. Let me add, with regard to the *farinacea*, that they do not seem so much disposed to resist putrefaction as greens or fruit; as appears by the cure of the sea-scurvy, and some experiments that I have made on that subject. See Append. paper iii. exp. xx. xxi.

(134) It is possible salted meat *without* vegetables, may have been one of the causes of the greater frequency of malignant fevers in ancient, than in modern times, but salted meat when well prepared, and eaten *with* vegetables and fermented liquors, has been proved to be an excellent preventive of the bilious and hospital fevers and of diseases of the bowels. A sudden and general change was perceived in the health of the American army during the revolutionary war as soon as salted beef and pork with potatoes, became a part of the daily rations of the soldiers. The same aliments have often been found equally beneficial in other communities and in private families.

* Append. paper iv. exp. xxvi.

sentery,* and few bilious fevers of a bad kind; or indeed, excepting the small-pox and measles, any putrid distemper that could be called general. In some of the lowest, moistest and closest parts of the town, and amongst the poorer people, spotted fevers and dysenteries are still to be seen; but which are seldom heard of among those of better rank, living in more airy situations. Although many things relating to health might be here better regulated, yet some of the main points have been well attended to; such as regard the privies, the common sewers, and the supplies of fresh water: add, that the people in general are very cleanly.

The common dirt of the streets does not seem to affect the health of the inhabitants of great cities; and though the more offensive kind of it may concur with other things to render the air less healthful, yet it appears to have little influence in producing pestilential diseases. (135) Stale urine abounds with a volatile alkaline salt that resists putrefaction;† and the common *feces* are rendered less, if at all, infectious, by means of a strong acid united with the parts which are really corrupted.‡ The case is different in putrid disorders, and especially in the dysentery, where the *feces*,

* In autumn 1762, the dysentery, though frequent, could not be called epidemic. It prevailed chiefly among the lower people, and in general was of a benign kind. See page 223.

(135) There can be no doubt of the truth of this remark. There is a material difference between dirt, and filth. The former which usually covers the middle of the streets of cities, is composed of earth, and is incapable of putrefaction; the latter which consists of dead vegetable and animal matters, when putrid, is the source of febrile diseases. When perfectly dry, it is as inoffensive as dirt.

† Append. paper i. exp. ii. iii.

‡ Append. paper vii. exp. xliii. Add the experiments of M. Homberg *sur la matiere fecale*. Hist. de l'Acad. R. de Sciences, A. 1711. Hoffman, Med. Rat. Syst. tom. i. lib. i. sect. ii. cap. vii.

as we have already shown, are in a state of corruption, and contagious.*

I shall conclude this part of my subject with observing, that whilst great cities furnish many materials for vitiating the air, they are provided with two considerable antidotes; the first arises from the circulation of the air, by means of the constant motion of the people and carriages, and of the draughts made by fires; the other from the quantity of an acid, produced by fuel, the strongest resister of putrefaction.

II. Thus far the remote, and external causes of the hospital and other malignant fevers seem to be sufficiently ascertained. But in what manner these putrid *effluvia* act, and produce the various symptoms within the body, is not so easily determined, and therefore what follows is to be considered as conjectures only.

I conceive that the *miasma* or septic ferment (consisting of the *effluvia* from putrid substances) being received into the blood, may have a power of corrupting the whole mass.† The resolution of the blood, and sometimes even its smell in the advanced state of a jail-fever, the offensiveness of the sweats and other excretions, the livid spots, blotches, and mortifications, incident to this distemper, seem to be proofs of what is here advanced.(136) The acrimony irritates

* Part i. ch. iii. Part ii. ch. ii. § 3. Part iii. ch. vi. § 1.

† See the Append. paper vii. exp. xlvi.

(136) The miasmata which produce fevers do not act as putrid ferments upon the blood. It is incapable of putrefaction in a living animal. Of course there is no such disease as a putrid fever. The change in the blood in fevers, supposed to be putrid, is induced entirely by the violent or feeble action of the blood vessels, upon it. It is more consonant to modern pathology and to reason, to call such fevers gangrenous. They arise from the same causes which produce local gangrene, and the effects are the same in both cases. It is to be regretted that our author's practice was influenced in several instances by his belief in a putrid diathesis in the blood in fevers. For example in pages 114 and 115 he rejects

the nerves and occasions various spasms; the pulse is quickened, at first raised, but soon depressed, from the heart not receiving enough of the vital principle, or from a resolution of its fibres, occasioned by putrefaction. I have elsewhere produced instances of the heart being so far relaxed, in the true plague, as to become uncommonly large, by the ordinary force of the blood.*

Yet, were putrefaction the only change made in the body by contagion, it might be easy to cure such fevers by the use of acids only, or other antiseptics. But as the disease, when once formed, is not to be removed by such means alone, it would therefore seem that some part of the brain is inflamed early, and that the fever is chiefly kept up by that inflammation;† that to this circumstance most of the symptoms are owing; and that in the advanced state, a cure cannot be obtained till the obstructing matter is resolved, or suppurated.

That this may be the case, is not improbable, from observing some affinity between the symptoms of this fever, and those of the low and nervous kind, which carry marks of inflammation of some part of the brain; though the cause has not arisen from any apparent putrefaction. The sinking of the pulse, pale urine, sweats not critical, confusion of the head, decay of strength, dejection of spirits, *subsultus tendinum*, and *tremor* of the muscles, are common to both; and therefore, considering the appearance of the brain in those who died of the hospital-fever, it seems not unreasonable to conclude, that some of these symptoms may

a mixture of the testacea with nitre as a remedy for fevers lest they should act as septics upon the blood. Modern chemistry has taught us to expect antiseptic qualities from them upon the contents of the bowels, and modern practice has proved not only their safety, but their efficacy in fevers erroneously supposed to be of a putrid nature.

* Append. paper vii. exp. xlvi. † See the dissections.

depend upon the inflammation, and others on the sup-
puration of that organ.

May not an argument for a septic ferment be also drawn from the cure? Thus, before the inflammation is fixed, are not the septic particles expelled by sweating, and other discharges? After that period, is not the most effectual method, to support the strength, but so as not to increase the inflammation? Near the end of the last stage, the humours being resolved by putrefaction, is not the obstruction removed; and at that time have not the stronger antiseptic, and cordial medicines, place, in order to correct, and to enable nature to expel what is so much vitiated? In this low state, are not the volatiles sometimes useful for raising the pulse; is not wine the best cordial; and do not we find that not only wine, but camphire, *serpentaria*, and the bark, *viz.* the most efficacious medicines here, are considerable antiseptics?*

Now these are the remarks which I have made on the nature, the cure, and the causes of malignant or pestilential fevers. In the description, I have endeavoured to distinguish them from all others, as far as I could do it in distempers whose symptoms are so much alike. The nervous fevers are frequently accompanied with miliary eruptions, which have no resemblance to the *petechiæ*; nor have I ever happened to see miliary eruptions in this malignant kind. The nervous fevers seem to belong to the inflammatory, and to what has been called, the bilious class of diseases, though incident to those chiefly who are of a weak or lax habit. But whatever be the cause of nervous fevers, if they end in petechial spots, putrid sweats, or become contagious, we may from thence conclude, that by the long continuance of the disease, the humours are be-

* Append. paper ii. exp. xi. xii. xiii.

come putrid; or, in other words, that the nervous fever is changed into one of a malignant form, akin to that of hospitals and jails.

CHAPTER VIII.

Observations on the Itch.

IN the division of the diseases most incident to an army, this was the last mentioned. Although it be of a contagious nature, yet the infection is communicated only by the contact of the diseased person, or by his clothes, bedding, &c. and not by *effluvia*, as in the dysentery and hospital-fever. It is confined to the skin, and seems best accounted for by Leeuwenhoek, from certain small insects which he discovered in the pustules by the microscope.* So that the frequency of the itch, in the army, is not to be ascribed to the change of air, or diet, that soldiers are exposed to upon expeditions, but to the infection propagated by a few (who happen to have it at first setting out) to others in the same ship, tent, or barrack.† But of all places the hospitals are most liable to this contagion, as receiving all sorts of patients. Hence I have observed,

* Since the first edition was published, I found a paper in the Phil. Transact. for the year 1730, called, *An abstract of a Letter from Dr. BONOMO to Signor REDI, containing some observations concerning the worms of human bodies*; by which account, I find that Dr. BONOMO was the first who discovered these *animalcula*, and who likewise proposed curing the itch by external applications only.

† Part i. ch. ii.

that after the crisis of fevers the itch generally appeared, though the person was free from it when admitted.

One therefore unacquainted with this disorder might be apt to mistake it for a miliary eruption, especially as these two bear a nearer resemblance to each other, than could be expected in two ailments of so different a nature. But those who know how seldom the miliary eruptions, and how frequently the other are seen in the army, will be less liable to fall into this error. The two may also be distinguished by the following marks: the miliary pustules, though not confined to the neck and breast, yet are most numerous and visible there; whilst the itch infects mostly the parts between the fingers, the inside of the wrists, the sides of the belly, and the hams. The miliary pustules appear before the fever has ceased, they are attended with little itching, and go off of themselves; whereas the itch is not perceived till after the crisis, in the convalescent state, when it increases daily and becomes very troublesome.

Although an army cannot be entirely freed from the itch, yet the cure of each individual is more certain in that than in most other distempers; and the remedy is so well known that I scarce need mention it. But I have seen this method oftener fail with the officers than with the private men; because the latter having no change of dress, what they wore was purified by the medicine, at the same time that they themselves were cured; whilst the former catching the itch, have sometimes kept it longer, from the circulation of infection between their body and their clothes.

Sulphur is the specific remedy of this disease, and is both more safe and more efficacious than mercury. For unless a mercurial ointment were to touch every part of the skin, there could be no dependence upon it:

whereas by a sulphurous application, a cure may be obtained by partial unctions only. It would seem as if these, as well as other insects, were killed by the steams of brimstone, though only raised by the heat of the body. And as to the internal use of the mercury, which some have accounted specific, we have known several instances, in the hospital, of men undergoing a complete salivation for the cure of the *lues Venerea* without being cured of the itch. The ointment which I mostly used was made in this manner:

℞ *Sulphuris vivi præparati* ℥i. *radicis hellebori albi in pulverem subtilissimum contritæ* ℥ii. (vel *salis Ammoniaci crudi* ℥j) *axungia porcina* ℥iiss. *misc.*

This quantity served for four unctions; and the patient was rubbed every night. But to prevent any disorder that might arise from stopping too many pores at once, I commonly began with anointing only a fourth part of the body at a time. Some are said to cure this disease by rubbing the legs only; but that method I never tried, believing that the medicine would be more efficacious by touching the whole skin.

Although the itch may be thus removed by one pot of ointment, yet it will be proper to renew the application, and to rub the parts most affected for some nights longer, till a second, or a third quantity be also exhausted. In some bad cases, we are obliged to continue to anoint the whole body for several nights together, and also to subjoin the internal use of sulphur; not with a view to purify the blood, but to diffuse the steams more certainly through the skin; as the *animalcula* may sometimes lie too deep to be thoroughly destroyed by an external application only.

As these fumes may heat the blood, at a time when the perspiration is so much impeded, it is proper that the patient should keep all the while to a cool diet, and

guard against cold.(137) If he be of a full habit, or in any degree feverish, he should bleed and take a purge;

(137) The Editor once saw the hospital fever induced in some soldiers by rubbing them with a composition of sulphur and hog-lard for the cure of the itch. This fact shows the propriety of the advice given by the Author to avoid taking cold during the external use of a remedy so much disposed to obstruct perspiration.

Our Author has recommended the use of ardent spirits by soldiers in several places, in treating of the means of preventing their diseases. The Editor has reserved a few remarks upon this advice for the concluding part of his labours, in order, by giving them in a connected and concentrated state, to render them more impressive upon the minds of his readers. He does not think ardent spirits should form a part of the daily ration of the soldier. They induce a predisposition not only to camp, but to many chronic diseases. They likewise weaken the discipline of an army. Most of the punishments inflicted upon soldiers are for neglect of duty, or for crimes committed while they were under their influence. It is a vulgar error to suppose, that the fatigue arising from violent exercise or hard labour is relieved by the use of spirituous liquors. The principles of life are the same in a horse as in a man, and yet we find that noble animal undergoes the severest labour in the extremes of warm and cold weather, with no other liquor than simple water. Our country affords many instances, especially among the societies of friends and methodists, of the labours of the harvest being more easily sustained by the use of milk and water, or molasses and water, than by the transient stimulus of rum and water. General Wolfe, whose genius embraced every thing that belonged to the health and comfort, as well as to the discipline and prowess of an army, never suffered a drop of ardent spirits to be issued to his soldiers except when they served as sentries, or upon fatigue duty in rainy weather. These are probably the only cases in which a small quantity of spirits may be useful. The substitutes for these destructive liquors should be

1. Vinegar and water, with or without a little molasses. Vinegar and water constituted the only drink of the Roman armies in their long marches over burning sands with a weight of sixty pounds in military weapons attached to each soldier, and yet we read of scarcely any diseases among them.

2. Milk and water, or molasses and water.

otherwise neither of these evacuations seem to be necessary.

The nature of the itch has been often mistaken, whilst some have referred it to the leprous, and others to the scorbutic class of diseases; but it appears to be a distemper *sui generis*, or at least different from either of those two. The *psora* mentioned by the Greek writers, and the *scabies* by the Latin, have been generally supposed to be this very eruption; but as this is not evident from the description which I have read of them,* I should conclude, that though other diseases of the skin seem to have been formerly no less frequent than at present, perhaps more, yet the itch was either altogether unknown, or at least uncommon among the ancients; since they take such particular notice of other cutaneous foulnesses, and omit this wholly.

Further, it may be observed, that in the most marshy

3. As drink is often called for, rather to obviate fatigue than to allay thirst, certain cordial articles of aliment should be taken with it, or preferred to it. These should be onions, garlic, the dried fruits of our country, a piece of dried beef, a neat's tongue, a sausage, or a little sugar. The American Indians use no other cordial to support them in their long and fatiguing marches, than a few spoonful of a mixture of the fine powder of *green* corn dried, and maple sugar, which they carry with them in baskets, mixed with a little water. The strength acquired by all these articles is of a durable nature, and is not followed, like that derived from the temporary effects of spirits upon the body, by languor, sickness, and a predisposition to camp diseases.

The Editor cannot close his notes upon this excellent work without expressing his respect to the memory of its illustrious author, to whom he was introduced by Dr. Franklin in London in the winter of 1769, and who did him the honour to admit him, when a student of medicine, to a conversation party held at his house once a week, where he met with a number of the most respectable physicians of London, and from which he derived both pleasure and instruction.

* PAULUS, lib. iv. cap. ii. CELSUS, lib. v. cap. xxviii.

parts of the Low-Countries, where the true scurvy is so general and bad, the itch is scarce known; and that though both the scurvy and the itch may meet on board our ships, yet they are to be considered as two distinct ailments; the former, arising from foul air, bad water, corrupted provisions, and the want of vegetables; the other, from contagion; each requiring a different cure.

Both the *scabies*, and the various kinds of the *impetigo** of the ancients, seem at present to be confounded under the general, but improper, appellation of *scorbutic eruptions*.† The former are chiefly distinguished by the hardness of the skin in one or more parts of the body, attended with a dry scurf, or pustules, or scabs; and generally with some degree of itching. But they are so far from being always curable by external applications only, that it is sometimes dangerous to attempt to subdue them in that manner. There it is thought necessary to change the humours by a spare diet, frequent purges of the saline kind, or by mercurial or other medicines, which have little or no efficacy in curing the itch, and which rather increase than cure the true scurvy.

* It would seem, that by the *impetigo*, CELSUS means the *lepra Græcorum*. *Vid. loc. cit.*

† The true scorbutic spots are of a livid colour, not commonly scurfy, or raised above the skin, and are attended with manifest signs of a lax state of the fibres, and a corruption of the blood. For a real scurvy imports a slow, but general resolution or putrefaction of the whole frame; whereas the *scabies*, *impetigo* or leprosy may be found to affect those of a very different constitution.

APPENDIX,

CONTAINING,

I. EXPERIMENTS UPON SEPTIC AND ANTISEPTIC SUBSTANCES,

WITH

Remarks relating to their Use in the Theory of Medicine, in
several Papers read before the Royal Society.

AND

II. AN ANSWER TO PROFESSOR DE HAEN AND M. GABER,

CONCERNING

Some Remarks made by them on the preceding Work.

APPENDIX.

PAPER I.

Experiments showing that putrid substances are not to be called alkaline; that neither the volatile nor fixed alkaline salts tend naturally to promote putrefaction within the body, being of themselves antiseptic. That the combination of two antiseptics may produce a third weaker than either. Experiments upon the comparative powers of some neutral salts in resisting putrefaction. And of the antiseptic qualities of myrrh, camphire, snake-root, camomile-flowers, and the Peruvian bark.

Read June 28, 1750.

ALTHOUGH an inquiry into the manner how bodies are resolved by putrefaction, with the means of accelerating, or preventing that process, has been reckoned not only curious but useful,* yet we find it little prosecuted in an experimental way; nor is it to be wondered at, considering how offensive such operations are. But as I have been led to make some experiments and remarks on this subject, by my having had an uncommon number of putrid distempers under my care in the hospitals of the army, I shall venture to lay before the society what I have found different from the common opinion; as well as some facts, which, as far as I know, have not been mentioned before.

* Lord Bacon calls the inducing or accelerating putrefaction, "a subject of very universal inquiry;" and says, that "it is of an excellent use to inquire into the means of preventing or staying putrefaction; which makes a great part of physic and surgery." *Nat. Hist. Cent.* iv.

Finding it a received opinion, that bodies by putrefaction become highly alkaline, I made the following experiments to inquire how far this may be true.

EXPERIMENT I.

The *serum* of human blood putrefied made, with a solution of the corrosive sublimate, first a turbid mixture, and afterwards a precipitation. This is one of the tests of an alkali, but scarce to be admitted here; since the same thing was done with the recent urine of a person in health, which is not accounted alkaline. The same *serum* did not tinge the syrup of violets green, and showed no effervescence when the spirit of vitriol was poured upon it. I made the experiment twice with portions of a different *serum*, both highly putrid; and once with water in which corrupted flesh had been some time infused; yet the most I could find was, that having previously given the syrup a reddish cast with an acid, this colour was rendered fainter (which might be the effect of dilution) but was not destroyed by the putrid humours. And as to effervescence, having dropped some spirit of vitriol into those liquors singly, and also when diluted with water, the mixture was quiet, and only a few air-bubbles appeared on shaking the glasses. Upon the whole, though there were some marks of a latent alkali in the putrid *serum*, yet they were so faint, that a quantity of water equal to that of the putrid liquors, mixed with only one drop of the spirit of hartshorn, being put to the same trial, discovered more of an alkaline nature.*

* My conclusion from this experiment was too general, as will appear by a remark made by M. Gaber: see *An Answer*, &c. at the end of the Appendix.

EXPERIMENT II.

It has been a maxim, that all animal substances being distilled after putrefaction, send forth a large quantity of volatile salt, in the first water; but Mr. Boyle found that this held good in urine only, and that in the distillation of the *serum* of human blood putrefied, the liquor which came first over had little strength; either as to its smell or taste, and did not at first effervesce with an acid.* And here it may be observed, that the chemists have frequently applied those properties which they discovered in urine to all the humours indifferently, whereas, in fact, there is a great diversity. For some animal substances, such as the urine, the bile, and the *crassamentum* of the blood soon putrefy; the *serum*, the *saliva*, and the white of an egg, slowly. Yet those which soonest corrupt do not always arrive at the highest degree of putrefaction. Thus the bile is soon corrupted, but the rankness of it is sensibly less than that of flesh; and the white of an egg is not only less disposed to putrefy than the yolk, but when putrid yields a different and less offensive smell; and it seems peculiar to stale urine to contain an alkaline salt, which, without distillation, makes a strong effervescence with acids; whilst most other animal humours putrefied, though they have a more intolerable *fætor*, yet contain less volatile salt, less extricable, and scarce effervescing with acids. What makes the difference between stale urine and other putrid substances still greater, is its inoffensiveness with regard to health; whilst the *effluvia* from other animal substances have oftentimes been the cause of pestilential diseases.

* Nat. Hist. of the human blood, vol. iv. page 178. fol. ed.

Now upon finding in urine a greater quantity of volatile salt, and that more easily separable than from any other humour, and that stale urine is the least noxious of putrid animal substances; so far from dreading the volatile alkali as the deleterious part of corrupted bodies, from this instance, we should rather infer it to be a sort of corrector of putrefaction.

EXPERIMENT III.

Daily experience shows how harmless the volatiles are, whether smelled to, or taken in substance; but still there remains a prejudice, as if these salts, being the produce of corruption, should therefore hasten putrefaction, not only in distempers where they are unwarily given, but also in experiments out of the body.

As to the effects arising from the internal use of them, little can be said, unless the kind of the disorder were precisely stated. For supposing, that by their nature they were disposed to promote putrefaction, yet if that be already begun, from a languid circulation, and obstruction, the volatiles may then, by their stimulating and aperient qualities, be the means of stopping its progress. And, on the other hand, though they were really antiseptic, yet if the humours are disposed to corruption, from excess of heat or motion, these very salts, by adding to the cause, may augment the disease. So that upon the whole, it will be the fairest *criterion* of the nature of these volatiles, to find whether, out of the body, they accelerate, or retard putrefaction.

1. In order to decide this question, I made repeated experiments of joining both the spirit, and the salt of hartshorn to various animal substances, and I con-

stantly found, that so far from promoting putrefaction they evidently prevented it, and that with a power proportioned to their quantity.* The trials were made with the *serum* of the blood, and also with the *crassamentum*, after it had been dried by keeping. I once separated the thick inflammatory crust of pleuritic blood from the rest of the mass, and having divided it, I put one portion into distilled vinegar, the other into the spirit of hartshorn; and after keeping the infusions above a month, in the middle of summer, I found the piece which lay in the alkaline spirit as sound as that in the acid.

2. Another time, I put into a four-ounce phial about an ounce and an half of an equal mixture of ox's gall and water, with 100 drops of spirit of hartshorn; and in another, as much of the gall and water, without any spirit. The phials being corked were set by a fire, so as to receive about the degree of animal heat, and in less than two days, the mixture without the spirit became putrid; yet the other was not only then, but after two days longer, untainted.

3. I afterwards infused two drachms of the lean of beef in two ounces of water, adding half a drachm of the salt of hartshorn; another phial contained as much flesh and water, with a double quantity of sea-salt; in a third were only the flesh and the water, by way of standard: these phials were placed in a lamp furnace, in a heat varying between 94 and 103 degrees of Fahrenheit's scale. About eighteen hours after infusion, the contents of the phial, which served as a standard, were rank; and in a few hours more, that with the sea-salt

* Mr. Boyle had already observed, that fine urinous spirits added to blood, warm from the vein, would make it appear more florid, keep it more fluid, and long preserve it from putrefaction. *Phil. Transact. n. xxix. Abridg. vol. iii. ch. v. § viii.*

were also putrid; but the flesh with the volatile alkali was sound, and so continued after standing four and twenty hours longer in the same degree of heat. And that the smell of the hartshorn might occasion no deception, the piece of flesh was washed from the salt, and still smelled sweet.

4. About the same time, I took three peices of fresh beef, of the same weight as above mentioned, and laying two of them in gallypots, I covered one with saw dust, and the other with bran; but the third piece being strewed with salt of hartshorn powdered, I put into a four ounce phial which had a glass stopper. They were all three placed on the outside of a window exposed to the sun, and the weather being warm, the flesh in the gallypots began to smell on the third day, and on the fourth was quite putrid. Next day the phial was examined, when the flesh was washed from the salt, and found perfectly sweet. It was then dried, and salted again with hartshorn; and having stood in the house for some weeks, in hot weather, it was inspected a second time, and found to be as sound as before. Nor was the substance at all dissolved, but of such a consistence as might be expected after lying as long in common brine.* And lest it should be imagined that the flesh in the gallypots, by being more exposed to the air than that in the phial, became sooner putrid, I also inclosed flesh in phials, like that with the salt of hartshorn, and found the confinement rather hasten the putrefaction.

Now finding, by these and many other experiments of the same kind, that volatile alkaline salts not only do not dispose animal substances to putrefaction, out of the body, but even prevent it, and that more pow-

* The same piece, being kept a twelvemonth, continued untainted, and as firm as at first.

erfully than common sea-salt, we may presume that the same, taken by way of medicine, will *cæteris paribus* prove antiseptic; at least we cannot justly suppose them corruptors of the humours, more than wine or spirits, which used in immoderate quantities may raise a fever, and thereby accidentally be the occasion of corruption.

EXPERIMENT IV.

I likewise made several experiments with the fixed alkaline salts, and found that they possessed little less antiseptic powers than the volatile. The trials were both with the ley of tartar and the salt of wormwood. But here we must not confound the disagreeable smell of such mixtures, with one that is really putrid; nor the power which these lixivial have of dissolving some animal substances, with putrefaction.*

EXPERIMENT V.

From these experiments it was natural to conclude, that since acids by themselves were amongst the most powerful antiseptics, and that the alkaline salts were likewise of that class, a mixture of the two, to saturation, would resist putrefaction little less than the acid alone. But in the trials, which I made upon flesh, with a *spiritus Mindereri*, composed of vinegar saturated with salt of hartshorn; and with lemon juice saturated with the salt of wormwood, I found the antiseptic virtue considerably less, than when either the acids or alkalies were used singly.

* In the trials upon flesh, I observed that though the fixed alkaline salts seemed at first to loosen the texture of fibrous animal substances, yet after infusion for some days, those peices not only were not dissolved, but were firmer than others which had lain in water only.

EXPERIMENT VI.

As to the comparative powers of these salts upon flesh, I observed that half an ounce of lemon juice saturated with a scruple of the salt of wormwood, resisted putrefaction nearly as much as fifteen grains of nitre; and when the trial was made with ox's gall, that two drachms of that mixture were more antiseptic than a scruple of nitre. Again, that nitre, compared with the dry neutral salts, weight for weight, was more antiseptic in preserving flesh than any which I had tried. The *sal Ammoniacus* came next to it, and even exceeded it in the experiment with ox's gall. After these, the *sal diureticus*, *tartarus solubilis*, and *tartarus vitriolatus*, seemed to have nearly the same antiseptic power.

EXPERIMENT VII.

Thus far I have examined the common neutral salts, which, however powerful in resisting putrefaction, are inferior to some resinous substances, and even to some plants that I have tried. For myrrh, in a watery *menstruum*, was found at least twelve times more antiseptic than sea-salt. Two grains of camphire, mixed with water, preserved flesh better than sixty grains of sea-salt: and I imagine that could the camphire have been kept from flying off, or concreting to the sides of the phial, half a grain, or even less would have sufficed. An infusion of a few grains of Virginian snake-root, in powder, exceeded twelve times its weight of sea-salt. Camomile flowers have nearly the same quality. The Peruvian bark is also antiseptic; and if I have not found it so strong as the two substances last mentioned, I impute that, in some measure, to my not having been able to extract all its embalming parts in water.

Now, the watery infusions of vegetables possessing this balsamic virtue are the more valuable, in that being usually free of acrimony, they may be taken in greater quantities than either spirits, acids, the alkaline, or even the neutral salts. And as in the great variety of substances answering this purpose, there may be some other useful qualities annexed, it would not be amiss to review some part of the *materia medica* with this intention.

I shall add, that besides this remarkable power in preserving bodies, I discovered in some of those substances a sweetening or correcting quality, after putrefaction had actually begun. But those experiments I shall lay before the society at some other time, with a table of the comparative force of salts, and some further remarks upon the same subject.

PAPER II.

A continuation of the experiments and remarks upon antiseptic substances. A table of the comparative powers of salts in resisting putrefaction. Of the antiseptic quality of several resins, gums, flowers, roots, and leaves of vegetables, compared with common salt. Attempts to sweeten corrupted animal substances by means of camomile flowers, and the Peruvian bark. A conjecture about the cause of intermitting fevers; and about the action of the bark in curing them.

Read November 21, 1750.

HAVING in my last paper just mentioned the comparative force of a few salts, and of other substances in resisting putrefaction, I shall now lay before the society a particular account of those experiments, and of some others which I have made on that subject.

EXPERIMENT VIII.

Three pieces of the lean of fresh beef, each weighing two drachms, were put separately into wide mouthed phials. Two ounces of cistern water were added to each; in one, were dissolved thirty grains of sea-salt;* in another, sixty; but the third contained nothing but flesh and water. These phials were little more than half full, and being corked were placed in a lamp furnace regulated by a thermometer, and kept to the degree of heat of the human body.

In about ten or twelve hours after, the contents of the phial without salt had a faint smell, and in two or three hours more became putrid.† In an hour or two

* All these experiments were made with the white or boiled salt in common use here.

† These pieces were intire. But when they are beaten to the

longer, the flesh with the least salt was tainted, but that which had most remained sweet above thirty hours after infusion. This experiment was often repeated, and with the same result, allowance being made for some small variations in the degree of heat.

The use of the experiment was for making standards, whereby to judge of the septic or antiseptic strength of bodies. Thus, if water with any ingredient preserved flesh better than without it, or better than with the addition of the salt, that ingredient might be said to resist putrefaction more than water alone, or water with thirty, or sixty grains of sea-salt. But if, on the other hand, water with any addition brought on corruption faster than when pure, the substance added was to be reckoned a promoter of putrefaction.

The following experiments were therefore all made in the same degree of heat, with the quantities of flesh, water, and air, above specified; together with such septic, or antiseptic substances as shall be afterwards mentioned, and were all compared with the standards. But as the smallest quantity of salt preserved flesh little longer than plain water, I have always compared the several antiseptic bodies with the largest quantity; so that whenever any substance is said to oppose putrefaction more than the standard, I mean, more than sixty grains of sea-salt dissolved in two ounces of water.

EXPERIMENT IX.

I then examined other salts, and compared them in the same quantity with the standard, which being of all the weakest resister of putrefaction, I shall suppose

consistence of a pulp, with the same quantity of water, the putrefaction begins in less than half the time mentioned above.

it equal to unity, and express the proportional strength of the rest in higher numbers, as in the following table.

A table of the comparative powers of salts in resisting putrefaction.

Sea-salt	-	-	-	-	-	-	1
Sal gemmæ	-	-	-	-	-	-	1 +
Tartarus vitriolatus	-	-	-	-	-	-	2
Spiritus Mindereri	-	-	-	-	-	-	2
Tartarus solubilis	-	-	-	-	-	-	2
Sal diureticus	-	-	-	-	-	-	2 +
Sal Ammoniacus	-	-	-	-	-	-	3
Saline mixture	-	-	-	-	-	-	3
Nitre	-	-	-	-	-	-	4 +
Salt of Hartshorn	-	-	-	-	-	-	4 +
Salt of wormwood	-	-	-	-	-	-	4 +
Borax	-	-	-	-	-	-	12 +
Salt of amber	-	-	-	-	-	-	20 +
Alum	-	-	-	-	-	-	30 +

In this table I have marked the proportions by integral numbers, it being difficult, and perhaps unnecessary, to bring this matter to more exactness; only to some I have added the sign +, to show, that those salts are stronger than the number in the table by some fraction; except in the three last, where the same sign imports that the salts may be stronger by some units.*

* Five grains of borax was the smallest quantity compared with sixty grains of sea-salt; but from its holding out so much longer, I suspect that three grains would have been sufficient; in which case the force of this salt was to be estimated at 20: a singular instance of the strength of a salt, which so far from being acid, is rather alkaline, if we may judge by its urinous taste. One grain of alum was weaker than sixty grains of sea-salt, but two grains were stronger: the power therefore of alum lies between 30 and 60, but by the experiment, nearer the first of these numbers.

The vitriolated tartar is rated at 2, though more than thirty grains were taken to equal the standard; but as I perceived that all of it was not dissolved, an allowance was made accordingly. On the other hand, as part of the hartshorn flies off, its real force must be greater than is shown by the table. The salt of amber is little volatile; but as three grains thereof were found more preservative than sixty of the sea-salt, it must therefore be more than twenty times stronger. This is indeed an acid salt; but as the acid part, in so small a quantity, is inconsiderable, it should seem that the antiseptic power is owing to some other principle. The *spiritus Mindereri* was made of common vinegar and salt of hartshorn: the saline mixture, of salt of wormwood saturated with lemon-juice.* The alkaline part in either of these mixtures, with water only, would have resisted with a power of 4 +; so that the addition of the acid rendered these salts less antiseptic; viz. the *spiritus Mindereri*, by one half; and the saline mixture, by a fourth part; which was an unexpected circumstance.

EXPERIMENT X.

1. I proceeded to try resins and gums, and began with myrrh. As part of that substance dissolves in water, eight grains were made into an emulsion; but most of it subsiding, I could not reckon on a solution of more than one or two grains, which nevertheless having preserved the flesh longer than the standard, we may account the soluble part of myrrh perhaps about thirty times stronger than sea-salt.

* Both the *spiritus Mindereri* and the saline mixture being in a liquid form are compared with the dry salts, upon the quantity which they contain of the alkaline salt.

2. *Aloe, asa-fetida*, and *terra Japonica*, dissolved in the same manner as myrrh, like it subsided, and had the same antiseptic force. But gum *Ammoniacum* and *sagapenum* showed little of this virtue; whether it was, that they opposed putrefaction less, or that most of the antiseptic principle fell with the grosser parts to the bottom. Three grains of opium, dissolved in water, did not subside, and resisted putrefaction better than the standard. But I observed, that more air than usual was generated here, and that the flesh became more tender than with any of the stronger antiseptics.

3. Of all the resinous substances, I found camphire the strongest resister of putrefaction. Two grains dissolved in one drop of spirit of wine, five grains of sugar and two ounces of water, exceeded the standard; though during the infusion most of the camphire flew off, swam at the top, or stuck to the phial. If we suppose only the half lost, the remainder was at least sixty times stronger than sea-salt: but if, as I imagine, the water suspended not above a tenth part, then camphire will be three hundred times more antiseptic than sea-salt. That nothing might be ascribed to the minute portion of the spirit used in this experiment, I made another solution of camphire in a drop or two of oil, and found that mixture less perfect, but still beyond the standard.

EXPERIMENT XI.

1. I made strong infusions of camomile-flowers, and of Virginian snake-root; and finding them both much beyond the standard, I gradually lessened the quantity of those materials, till I found five grains of either impart a virtue to boiling water superior to the standard. Now, as we cannot suppose that these infusions contained half a grain of the embalming part of these ve-

getables, it follows, that this substance must be at least an hundred and twenty times more antiseptic than common salt.

2. I also made a strong decoction of the Peruvian bark, and infused a thin bit of flesh in two ounces of it strained; which flesh did not corrupt, though it remained two or three days in the furnace, after the standard was putrid. During this time, the decoction became gradually limpid, whilst the grosser parts subsided: by which it appears, that a most minute portion of the bark (perhaps less than of the snake-root or camomile-flowers) intimately mixed with water, is possessed of a considerable antiseptic virtue.

3. Besides these, pepper, ginger, saffron, contrayerva-root, and galls, in the quantity of five grains each, as also ten grains of dried sage, of rhubarb, and of the root of wild valerian,* separately infused, exceeded sixty grains of salt. The leaves of mint, angelica, ground-ivy, senna, green tea and red roses; as also the tops of common wormwood, mustard-seed, and horse-radish-root were likewise severally infused, but in larger quantities, and proved more antiseptic than the standard. And as none of these can be supposed to yield in the water above a grain or two of the embalm-ing principle, we may look upon them all as powerful resisters of putrefaction. Further, I made a trial with the decoction of white poppy-heads, and another with the expressed juice of lettuce, and found them both above the standard.

By these specimens we may now see how extensive antiseptics are; since, besides salts, vinous spirits,

* Although the experiment was made with ten grains of the powder of this root only, yet, considering how long that quantity resisted putrefaction, we may reckon valerian-root among the stronger antiseptics.

spices, and acids, commonly known to have this property, many resins, astringents, and refrigerants, are of the number; and even those plants called alkalescent, and supposed promoters of putrefaction; of which class horseradish is particularly antiseptic. And indeed after these trials I expected to find almost all substances endowed with some degree of this quality, till, upon further experiments, I perceived that some made no resistance to, and others promoted corruption. But before I enter upon that part of my subject, it will be proper to relate some other experiments more nearly connected with the preceding.

EXPERIMENT XII.

Having seen how much more antiseptic these infusions were than sea-salt, I then tried whether vegetables would part with this virtue, without infusion. For this purpose, taking three small slices of the lean of beef, each not exceeding the thickness of half a crown, into one I rubbed the powder of the Peruvian bark, into another that of snake-root, and into a third that of camomile-flowers. It was in the heat of summer, yet after keeping these pieces for several days, I found the flesh with the bark but little tainted, and the other two sweet. The substance of all the three was firm; in particular that piece with the camomile was so hard and dry that it seemed incorruptible. The reason why the bark had not altogether the same effect, depended probably on its closer texture.

EXPERIMENT XIII.

I have also made some attempts towards the sweetening of corrupted flesh by means of mild substances;

because distilled spirits, or strong acids, which might be supposed the most likely to answer this intention, are of too acrid and irritating a nature to be thoroughly useful when this correction is most wanted. And as to salts, besides their acrimony, it is well known that meat once tainted will not take salt.

A piece of flesh weighing two drachms, which in a former experiment had become putrid (and was thereby made tender, spongy, and to float in water) was thrown into a few ounces of a strong infusion of camomile flowers, after expressing the air, in order to make it sink in the fluid. That liquor was renewed two or three times in as many days, when perceiving the *fætor* gone, I put the flesh into a clean phial with a fresh infusion: this I have kept all the summer, and have it still by me, sweet and of a firm texture.† In the like manner I have succeeded, in sweetening several thin pieces of corrupted flesh, by repeated infusions in a strong decoction of the bark, and I have constantly observed, that not only the offensive smell has been removed, but a firmness restored to the fibres.

Now, since the bark parts with so much of its virtue in water, is it not reasonable to suppose, that it may yield still more in the body, when opened by the *saliva* and the bile, and therefore that in some measure it operates by this antiseptic virtue? From this principle we may perhaps account for its success in gangrenes, and in the low state of malignant fevers when the humours are apparently corrupted. And as to intermitting fevers, in which the bark is most specific, were we to judge of their nature from circumstances attending them, in climates and in seasons most liable to the distemper, we should assign putre-

† This piece I kept a twelvemonth after this paper was read at the Royal Society, and I found it then still firm and uncorrupted.

faction as one of the principal causes. They are the great epidemic of marshy countries, and prevail most after hot summers, with a close and moist state of the air. They begin about the end of summer, and continue throughout autumn, being at the worst when the atmosphere is most loaded with the *effluvia* of stagnating water, rendered more putrid by vegetables and animals dying and rotting in it. At such times all meats are quickly tainted, and dysenteries, with other putrid disorders, coincide with these fevers. The heats dispose the blood to acrimony, the putrid *effluvia* are a ferment,* and the fogs and dews, so common in such situations, stopping perspiration, shut up the corrupted humours, and bring on a fever. The more these causes prevail, the easier it is to trace this putrefaction. The *nausea*, thirst, bitter taste of the mouth, and frequent evacuations of corrupted bile are common symptoms, and arguments for what is advanced. We shall add, that in moist countries, and in bad seasons, the intermittents not only begin with symptoms of a putrid fever, but if unduly treated are easily changed into a malignant form, with livid spots or blotches on the skin, or a mortification of the bowels. At the same time it must be acknowledged, that such is the quick action of the bark in removing these fevers, that its febrifuge quality must be something different from its

* It will be proper to remark, that when I use here (as in the preceding observations) the word *ferment*, to denote the cause that changes the humours, I mean only to express the assimilating power of all putrid animal substances over the fresh, as shall be explained more fully in the next paper, under experiment xviii. There seemed to be the more need for this caution, as in one of the subsequent papers I am to show, that putrid animal substances become ferments in the strictest sense, that is, act like yeast, when joined to any vegetable substance capable of a vinous fermentation. See *exper. xxviii. and the following.*

antiseptic: and yet we may remark, that whatever medicines (besides evacuations and the bark) have been found useful in the cure of intermittents, they are mostly, so far as I know, powerful correctors of putrefaction, such as myrrh, camomile-flowers, wormwood, tincture of roses, alum with nutmeg, the vitriolic, or other strong mineral acids with aromatics.

Thus far having recited my experiments upon flesh or the fibrous parts of animals, I shall proceed to show what effects the antiseptics have upon the humours. For though from analogy we might conclude, that whatever retards the corruption of the solids, or recovers them after they are tainted, will act similarly upon the fluids, yet as this does not certainly follow, I judged it necessary to make some new trials, which, with some experiments on the promoters of putrefaction, the reverse of the former, shall be offered to the society at a future meeting.

PAPER III.

Experiments on substances resisting the putrefaction of animal humours, with their use in medicine. Astringents always antiseptics, but antiseptics have not always a manifest astringent. Of the use of putrefaction in general, and particularly in the animal economy. Of the different means of inducing putrefaction. Some substances reputed septic have a contrary quality. And the real septics are some of those substances which have been the least suspected to be of that nature, *viz.* chalk, the *testacea*, and common salt.

Read Nov. 1. 1750.

HAVING given a full account of the manner in which I tried the power of antiseptics on the fibrous parts of animals, I shall but just mention the result of some experiments made with them upon the humours.*

EXPERIMENT XIV.

Decoctions of wormwood, and of the Peruvian bark, also infusions of camomile-flowers, and of snake-root, preserved yolks of eggs several days longer not only than water did alone, but also when some sea-salt was added to it. I likewise found that salt of hartshorn preserved this substance better than four times its weight of sea-salt.

EXPERIMENT XV.

Ox's gall was kept some time from putrefaction by small quantities of the ley of tartar, spirit of hartshorn,

* All the following experiments, whether made in the lamp-furnace, or by the fire, were made in a degree of heat equal to that of the human blood, *viz.* about 100 degrees of Fahrenheit's scale.

sal Ammoniacus, and the saline mixture; and still longer, by a decoction of wormwood, infusions of camomile-flowers, and of snake-root; by solutions of myrrh, camphire, and salt of amber: all these were separately mixed with gall, and found more antiseptic than sea-salt, and seemingly in proportion to their effects upon flesh. Only nitre failed, which though four times stronger than sea-salt in preserving flesh, yet is inferior to it in preserving gall, and much weaker than the *sal Ammoniacus*; which, again, is somewhat less powerful than nitre in keeping flesh sweet. The nitre was soon opened by the gall, and emitted much air, which rose as from a fermenting liquor; and when this happened the gall had begun to putrefy.* But the saline mixture generated no air, and opposed the putrefaction of the gall more than it did that of the flesh.

EXPERIMENT XVI.

The last trial was with the *serum* of human blood, which was preserved by a decoction of the bark, and by an infusion of snake-root. But saffron and camphire were not here above a fourth part so antiseptic as before: whether it be that they are less preservative of this humour, or, as I suspect, that they were not sufficiently mixed with it. Nitre acted nearly with its full force, being about four times stronger than sea-salt; and it generated some air, but less than it did with the gall. No other humour was tried: but from these specimens, added to the former experiments, we may conclude, that whatever is a preservative of flesh

* Perhaps this may be the reason why, as I have observed, nitre disagrees with the stomach and bowels in cases of putrid bile.

will be universally antiseptic, though perhaps not always with the same force.

EXPERIMENT XVII.

Having shown how putrid flesh may be sweetened, I shall conclude that part of my subject with a like trial made upon the yolk of an egg. A portion of this diluted with a little water, having stood till it was corrupted, a few drops of it were put into a phial with two ounces of pure water, and about twice as many drops were mixed with a strong infusion of camomile-flowers. At first both phials had some degree of a putrid smell, but being corked, and kept a few days near a fire, in about the degree of animal heat, the mixture with plain water contracted a *fætor*, whilst the other smelled only of the flowers.

Thus far I have related my experiments made upon antiseptics, by which it appears, that besides spirits, acids, and salts, we are possessed of many powerful resisters of putrefaction, endowed with qualities of heating, and cooling, of volatility, astriction, &c. which make some substances more adapted than others to particular indications. In some putrid cases many correctors are already known, in others they are wanting. We are yet at a loss how to correct the *sanies* of a cancerous sore; but in such a multitude of antiseptics, it is to be hoped that some will be found at last adequate to that intention.

It may be further remarked, that as different distempers, of the putrid kind, require different antiseptics, so the same disease will not always yield to the same medicine. Thus, the bark will fail in a gangrene, if the vessels are too full, or the blood is too thick. But if the vessels are relaxed, and the blood resolved,

or disposed to putrefaction, either from a bad habit, or from the absorption of putrid matter, then the bark is specific. With the same caution are we to use it in wounds, *viz.* chiefly in the cases of absorbed matter, when it infects the humours and brings on a hectic fever. But when inflammatory symptoms prevail, the same medicine, by increasing the tension of the fibres (a state very different from the other) has such effects as may well be expected.

From the success of the bark in various putrid disorders, it should seem that astringency had no small share in the cure;* and indeed does not the nature of putrefaction consist in a separation and disunion of parts? But as there are other cases in which astringency is less wanted, we may find in the contrayerva-root, snake-root, camphire, and other substances, a considerable antiseptic power, with little or no appearance of astringency. And as several of these medicines are also diaphoretic, their operation, in this respect, may for that reason be the more successful.

I come now to the second thing proposed, which was, to give an account of some experiments made on substances hastening or promoting putrefaction, and which I shall likewise venture to lay before the Society. For setting aside the offensive idea commonly annexed to the word *putrefaction*, we must acknowledge it to be one of the instruments of Nature, by which some great and salutary changes are brought about. With regard to medicine, we know that neither animal nor vegetable substances can become aliment without undergoing some degree of putrefaction. Some

* Are not all astringents strong antiseptics; and have not all antiseptics some astringent quality, though not always manifest?

distempers may proceed from a want of it;* the crisis of fevers seems to depend upon it;† and perhaps even animal heat, according to Dr. Stevenson's theory.‡

* Some learned authors mean the same thing, when they express this by a defect of a due degree of *alkalescence* in the humours; but I have shown in my first paper how liable that term is to objections.

† It is observable that Hippocrates entertained the same idea, since he oftener than once uses the word signifying *to putrefy*, as synonymous to that which signifies *to concoct*. Thus, Fœsius remarks, Σήπειν, quod est putrefacere, Hippocrati concoquere significat; ut et σήψις, concoctionem. *Oecon. Hippocrat. in voce Σήπειν*. In some of the former editions of these experiments, by mistake, I quoted Gorræus for Fœsius; tho' indeed Gorræus, the younger, in his additions to his grandfather's *Definitiones Medicæ*, makes much the same remark, under the article Σηπτικὴ κοιλίη, when to that expression he subjoins, Hippocrati libello περὶ ανατομῆς de ventriculo dicitur ubi fit concoctio, velut cibos concoquens aut putrefaciens. Now, that the concoction of the ancients was a kind of putrefaction, seems probable from hence, that in this state of concoction, the humours are generally thinner, and fitter to pass through the smaller vessels, where they stagnated before. But *resolution* is one great mark of putrefaction. And we often find in the offensiveness of the sweats, or in other excretions consequent on a crisis, evident marks of corruption. The time of resolution or putrefaction depends on the degree of heat, the habit of the patient, and on the part obstructed: hence may arise the variety in the duration of fevers of different kinds, and the uniformity among others that are of a like nature. Resolution is the putrefaction of the impacted humour only, but suppuration implies a corruption of the vessels also. This manner of speaking has been disused, from the prejudice that nothing is putrid but what is offensively so; whereas, in fact, every fibre becoming more tender, and every humour becoming thinner, may be considered as resolved or putrid in some degree, whether the change tends to the better health, or to the destruction of the person, or whether it becomes more grateful, or more offensive to the senses.

‡ See an *Essay on the Cause of Animal Heat*, inserted in the *Medical Essays*, vol. v. In that treatise, the reader will find some curious remarks relating to animal putrefaction.

But in the prosecution of this subject I have met with few real septics, and found several substances, commonly accounted such, to be of an opposite nature. The most general means of accelerating putrefaction are by heat, moisture, and stagnating air; which being sufficiently known and ascertained, I passed over without making any new experiments about them. But Lord Bacon,* as well as some of the chemists, having hinted at a putrid fermentation, analogous to what is found in vegetables, and this having so near a connexion with contagion, I made the following experiment for a further illustration of that principle.

EXPERIMENT XVIII.

A thread being dipped in the yolk of an egg already putrid, a small portion of it was cut off and put into a phial, with half of the yolk of a new-laid egg diluted with a little water. The other half, with as much water, was put into another phial, and both being corked were set by the fire to putrefy. The result was, that the thread infected the fresh yolk; for the putrefaction was sooner perceived in the phial that contained the thread, than in the other. But this experiment was not repeated.

In this manner the putrefaction of meat may advance quicker in a confined, than in a free air; for as the most putrid parts are also the most volatile, they incessantly issue from a corrupting substance, and are dispersed with the wind; but in a stagnation of the air they remain about the body, and by way of ferment excite it to corruption.†

* Nat. Hist. cent. iv. exper. 330.

† Corpus in putredine existens, (corpori) a putredine libero facillime corruptionem conciliat; quia illud ipsum (corpus) quod in motu intestino jam positum est, alterum quiescens, ad talem

EXPERIMENT XIX.

As to other septics received by authors, I found none of them answer the character. The alkaline salts have been considered as the chief putrefiers; but this is disproved by experiments. Of the volatiles it may indeed be observed, that though they preserve animal substances from the common marks of putrefaction, with a force four times greater than that of sea-salt, yet, in warm infusions, a small quantity of these salts will soften and relax the fibres more than water does by itself. They also prevent the coagulation of blood;

motum tamen proclive, in eundem motum intestinum facile abripere potest. *Stahlii Fundam. Chymie*, par. ii. tract. i. sect. i. cap. v. In this light Stahl and other celebrated chemists have considered a *putrid ferment*, and generally used the same expression for it. Beccher (in *Physic. Subterranean*. lib. i. sect. v. cap. i. n. 34.) treating of a corrosive putrid substance taken in aliment, says of it, fermentum universo sanguini imprimit. And Mr. Boyle has used the words *fermentation* and *putrefaction* of the blood promiscuously in his piece called *Observations and Experiments on the Human Blood*. But these authors are nevertheless careful not to confound *putrefaction* with *vegetable fermentation*, accounting them only analogous processes; and therefore use the same term to express both the *putrefying* and *fermenting* agent, from the want of more expressive words in the languages in which they wrote. It were to be wished, that, to avoid ambiguity, we had two different words, to denote the exciting cause of these two intestine motions; but this is the less to be expected, on account of the disposition of all putrid animal substances to promote both animal putrefaction, and a vinous fermentation in vegetables, as will appear by the sequel of these experiments.

I have insisted the longer on this point, as I apprehended that my use of the term *ferment* in the preceding observations might induce some readers to think, that I had endeavoured to revive the exploded doctrine of a fermentation of the blood, like that which takes place among vegetable substances, than which nothing could be more contrary to my intention.

and when taken by way of medicine, perhaps thin and resolve it; but they are not therefore septics. For so little do these salts putrefy, or even resolve the fibres, when applied dry, that I have kept in a phial a small piece of flesh, preserved with salt of hartshorn only, since the beginning of June last (about five months ago) during which time, though the summer was hotter than usual, it has remained not only sound, but firmer than when it was first salted.*

EXPERIMENT XX.

From the specimens we had of the antiscorbutic plants, it is likewise probable that none of that class will prove septic. Horseradish, one of the most acrid, is a powerful antiseptic. And though carrots, turnips, garlic, onions, celery, cabbage, and colewort, were tried, as alkalescents, they did not hasten, but retard the putrefaction.

EXPERIMENT XXI.

The case was somewhat different with such farinaceous vegetables as I examined, *viz.* white bread in water, decoctions of flour, barley, and oatmeal; for these infused with flesh did not oppose its putrefaction; but after that process was somewhat advanced, they checked it by turning sour; and by a long digestion, the acidity so far prevailed as to overcome the corruption of the flesh, and to generate much air. These phials did not then ill represent the state of weak bowels, in which bread and the mildest grains

* This piece of flesh continued uncorrupted above a year after this paper was read at the society, and then I inspected it no longer.

are converted into so strong an acid, as to prevent the thorough resolution and digestion of animal food.*

EXPERIMENT XXII.

I examined the powder of *cantharides*, of vipers, and of Russian castor, all animal substances, and therefore most likely to prove septic. The flies were tried both with fresh beef, and with the *serum* of human blood; the vipers, with the former only; but neither of them hastened putrefaction. And as to the castor, it was so far from promoting that process, that an infusion of twelve grains opposed putrefaction more than the standard.

EXPERIMENT XXIII.

After finding no septics where they were most expected, I discovered some which seemed the least likely, *viz.* chalk, the *testacea*, and common salt.

Twenty grains of prepared crabs-eyes were mixed with six drachms of ox's gall and as much water; into another phial I put nothing but gall and water, in the same quantity with the former; and both being placed in the furnace, the putrefaction began much sooner where the absorbent powder was, than in the other phial. I also infused, in the same furnace, thirty grains of levigated chalk, with the usual quantity of flesh and water,† and having shaken the phial from time to time, I found that the corruption not only began sooner, but

* It is to be remarked, that in making this experiment, I did not then attend to a fermentation that ensued, and which was the cause of the acidity. This kind of fermentation between animal and vegetable substances, having been hitherto overlooked, shall be set forth in my next paper.

† *Viz.* of flesh two drachms, and of water two ounces.

rose higher by this mixture; nay, which had never happened before, that in a few days the flesh was resolved into a perfect *mucus*. The experiment was repeated with the same result, which being so extraordinary, I suspected that some corrosive substance had been mixed with the powder; but when for another trial, a lump of common chalk was pounded, I found thirty grains of it as septic as the former. The same powder was compared with an equal quantity of salt of wormwood, and care was taken to shake both the mixtures equally; but after three days warm digestion, the salt had neither tainted nor softened the flesh, whilst the chalk had rotted and consumed that piece which was infused with it. Nor was the septic power of the testaceous powders of the dispensatory less. But egg-shells, in water, seemed to resist putrefaction, and to preserve the flesh longer, than water did without them.*

EXPERIMENT XXIV.

To try whether the *testacea* would also dissolve vegetable substances, I mixed them with barley and water, and compared this mixture with another of barley and water only. After a long maceration by a fire, the plain water swelled the barley, became mucilaginous and sour; but that with the powder kept the grain to its natural size, and though it softened it, yet produced no mucilage, and did not become acid.

EXPERIMENT XXV.

Nothing could be more unexpected than to find sea-salt a hastener of putrefaction; but the fact is thus.

* The trial was made only with a coarse powder of egg-shells, and not repeated.

One drachm of salt preserves two drachms of fresh beef, in two ounces of water, about thirty hours uncorrupted, in a heat equal to that of the human body; or, what amounts to the same, this quantity of salt keeps flesh sweet about twenty hours longer than pure water; but half a drachm of salt does not preserve it above two hours longer than water. This experiment has been already mentioned. Now, I have since observed, that twenty five grains have little antiseptic virtue, and that ten grains seemed both to hasten and heighten the corruption.* It is further to be remarked, that in warm infusions of these smaller quantities, the salt, instead of hardening the flesh (as it does in a dry form, in brine, or even in strong solutions, such as our standard) softens and relaxes its texture more than plain water does, though much less than water with chalk, or water with the testaceous powders.

Several inferences might be drawn from this experiment, but I shall only mention one at present. Salt, the indispensable seasoner of animal food, has been supposed to act by an antiseptic quality, correcting the too great tendency of meats to putrefaction; but as it is never taken in aliment beyond the proportion of the corrupting quantities in our experiment, it would seem that salt is subservient to digestion chiefly by its septic virtue, that is, by softening and resolving meats; an action very different from what is commonly imagined.†

* I have found the most putrefying quantity of salt, with this proportion of flesh and water, to be about eight or ten grains.

† Beccher is the only author, I know of, who mentions the resolving quality of sea-salt, and also its corrosive and putrefying nature, when taken too freely in aliment. *Vide Physic. Subterr. lib. i. sect. v. cap. i.*

It is to be observed, that all these experiments were made with the salt kept here for domestic uses.

PAPER IV.

A continuation of the experiments upon septics. Conjectures about the causes of the decline of putrid diseases. Of the difference between the effects of the *testacea* and lime-water. A power discovered in putrid animal substances of exciting a vinous fermentation in vegetables. Of what use the *saliva* is in that process. And the application of these experiments to the theory of digestion.

Read April 25, 1751.

IT being so prevailing an opinion, that salt resists putrefaction with a power proportioned to its quantity, I did not therefore rely on my first trials, but having often repeated the experiment which contradicted that notion, I still found, that two drachms of fresh beef, with five, or ten grains of sea-salt, and two ounces of water, putrefied sooner than the same quantity of flesh infused with water only.

EXPERIMENT XXVI.

1. I next inquired, whether small portions of other neutral, or alkaline salts, were in like manner septic; but upon examining *tartarus vitriolatus sal Ammoniacus*, nitre, and *sal diureticus*, as also salt of hartshorn, and salt of wormwood, I could not perceive that they were so; though all of them, in weak solutions, were found to soften or resolve the flesh; salt of hartshorn most and nitre least of any.

2. Nor did sugar at all promote putrefaction. A plain syrup has been said to preserve flesh better than any brine; and the trials which I have made induce me to think that this is true; as also, that weak solutions of sugar are proportionally antiseptic. But, what

is remarkable here, though weak solutions of sugar soon yield to the putrefaction of flesh, yet as soon as an acidity is produced by the fermentation of the sugar, that putrid tendency is either retarded, or entirely overcome. Therefore, in sugar, the effects both of the *farinacea* and the salts seem to be united; for as a salt, it opposes putrefaction at first, which the *farinacea* do not; and like the *farinacea*, it checks putrefaction after the fermentation begins.

To this antiseptic quality in sugar (which, for above a hundred years past, has been daily joined in large quantities to other acescent food) we may perhaps attribute some share of the general decline of putrid diseases. For how seldom do we hear of leprosy,* putrid scurvies, dysenteries, pestilential fevers, and the like distempers, formerly so frequent, and to which those were most subject who used animal food in excess, especially salted meats.† No doubt other causes concur, but to enumerate them would be foreign to our present purpose, as well as to mention the inconveniences that, on the other hand, may arise from the immoderate use of such things as too much oppose putrefaction.

3. I likewise repeated the experiments with the *testacea*, and in particular on human blood, and found, that crabs-eyes promoted the putrefaction of the *crasamentum*, and likewise that of the *serum*, but the latter not so speedily.

EXPERIMENT XXVII.

1. Having a mind to see the action of the *testacea* combined with some antiseptics, I infused half a

* *Viz.* the *lepra Arabum*.

† Add what is said in the preceding Observations, part iii. ch. vi. § 6.

drachm of the compound powder of contrayerva-root with the usual quantity of flesh and water, and observed, that the testaceous part of this composition did sensibly weaken the vegetable, which is one of the strongest antiseptics. For though, upon the whole, the powder did indeed resist putrefaction, it was with less efficacy than if the small portion of the root, which enters the composition, had been used alone.*

2. To this examination of chalk and the *testacea*, were added some experiments upon lime-water, made both of chalk-lime, and oyster-shell-lime (for stone-lime is not in use here) and I found, that though flesh infused in either, immediately sent forth a disagreeable smell, as in a common ley, yet it did not become putrid so soon as the standard. So that in this trial, lime-water made some resistance to putrefaction,

* The high opinion which some physicians of the last century entertained of the *testacea* was founded on the *hypothesis*, that most diseases proceeded from an acid, not even fevers excepted. Now, though this theory is at present much limited, yet the practice is still common, at least in acute disorders; some using these powders from custom, and others with a view to neutralize the acids then given to fit them for entering the lacteals and promoting a *diaphoresis*. Otherwise it does not appear how these absorbents should correct any acrimony, either in the *primæ viæ*, or in the blood. But whatever disputes have arisen about their manner of operating, almost all have agreed in believing them harmless, though from these experiments we may perhaps be led to doubt whether they are so always. However, I would not from hence infer, that the *testacea* are only to be given when an acid is to be destroyed; since to cure some diseases, it may be requisite to attenuate the humours, and relax the fibres by some degree of putrefaction. Hippocrates observes, that a fever is the best remedy for some disorders. And the primary effects of mercurials seem to consist in some degree of a septic resolution both of the fibres and humours. Possibly therefore the crisis of some fevers may be hastened, or perfected by the *testacea*; though I should rather believe that they were of little consequence in the cure.

though the materials of which it was made, namely, chalk and shells, were both septics. Nevertheless I observed, that when the putrefaction began, it became little less offensive in this than in common water.* And though it has been observed by others, that the water of stone-lime is in some degree constantly antiseptic, yet I think it probable, that the virtues of that medicine do not so much consist in preventing putrefaction, as in checking immoderate acidities and concretions, which may be supposed to be the cause of several chronic disorders.

Thus far I have related my experiments upon substances resisting, and promoting putrefaction; by which it seems probable, that there are a great number of the former, and but few of the latter, though perhaps more than we have yet discovered. In this last part, I have confined my inquiries to such things only as induce putrefaction out of the body; for as to mercury, and certain poisons, which taken into the stomach, or absorbed by the veins, have the effect of septics, I purposely omitted them, as not being able to take in so large a field. But I shall add, to what I have already laid before the Society, some other observations upon the corruption of animal substances, which have a near relation to the former, and may not be without their use in medicine.

* The Rev. Dr. Hales having since made some experiments upon lime-water, confirms what is here said about the little antiseptic quality of shell or chalk-lime. And though he does not mention his having ever found them act as septics, yet he lays before the Royal Society my account how that may happen, *viz.* whenever the chalk or shells are not sufficiently calcined. *Phil. Transact.* vol. xlvi. n. 103.

EXPERIMENT XXVIII.

I made several mixtures, each consisting of two drachms of raw beef, as much bread, and an ounce of water; and these being beaten to the consistence of a pulp (as in all the rest of these experiments) were put into close phials, of three or four ounces measure, and placed in the usual heat of 100, degrees. But in this, and in several of the subsequent experiments, the lamp did not burn the whole night.

1. In a few hours, all these mixtures began to ferment, and continued in that action about two days.* For the most part the fermentation was so strong, especially when the heat was a few degrees above the standard, that, if the corks had not sometimes given way, the phials must have burst. The bread and flesh, which at first lay at the bottom, soon rose to the top, and constantly, as the air escaped, let fall some particles that had been buoyed up by that fluid. Thus a sediment was formed resembling lees, whilst the lightest parts or flowers remained on the surface; but the fermentation continuing, these also subsided; and the acid taste and smell of the liquors, after the action ceased, was a further proof of the preceding fermentation. This change was the more unexpected, as these mixtures, when the motion began, were tending to corruption, and in fact, in a few hours after, became offensive; but the next day, the putrid smell abated, and went quite off before the fermentation ceased.

2. I repeated this experiment often, and with the same success. And to ascertain the part which the

* I found afterwards, that when the phials were left quite open, or so that the air could easily escape, the fermentation was completed in less than half that time.

animal substance had in producing such effects, I made mixtures of bread and water only; but these stood several days in the furnace without any sign of fermentation.

3. To two drachms of fresh meat I added double the quantity of bread, and water in proportion; and having placed that mixture in the furnace, I found the fermentation proceed as before, and with no other difference than that of producing a purer acid.

4. To the same quantity of flesh and an ounce of water, was added only half a drachm of bread; but a fermentation nevertheless ensued, and the liquor became acid to the taste, but with the smell of rank cheese.

5. Another variation was made with flesh and oatmeal, instead of bread; but the effects were only different in a higher degree of fermentation, as the oatmeal had not undergone that process before.

6. I tried whether oatmeal and water would ferment alone; but though they did, the action was not nearly so strong as when an animal substance was added.

7. Experiments were also made with bread and roasted meat, with similar effects; for though the putrefaction was but just discernible, and the generation of air was much less than in the first experiment, yet the fermentation was complete, and the mixtures became acid.

8. I varied the quantity, taking, of roasted meat and bread each an ounce, with about two ounces of water. This mixture being poured into a phial and corked, was left in a room with a fire, where the thermometer rose no higher than about 65 degrees. Here the fermentation began late, and proceeded slowly; but, what was remarkable, it no sooner commenced, than the mixture, without ever becoming putrid, acquired a

vinous smell like that of other fermenting liquors, and towards the end, the usual acid taste and smell succeeded.

9. I mixed half an ounce of bread with an ounce and a half of water, and a small portion of the *crassamentum* of human blood already putrid; and setting this mixture in the furnace, in a close phial, I observed a strong fermentation some hours after.

10. I discovered the same quality in sheep's gall. For, having put two drachms of bread, with half an ounce of that liquor, in a phial, and placed it in the furnace, I perceived that this mixture, the next day, generated air as in the former experiments. The fermentation continued for two days; in which time the gall began to putrefy, but recovered afterwards; so that on the sixth day it seemed to be as uncorrupted as on the first, without becoming acid.

From all these experiments it seems probable, that all animal substances putrid or tending to putrefaction are endowed with a power of raising a fermentation in the *farinacea*, and even of renewing that action in such as have undergone some degree of it before.

11. After such mixtures become sour, they never return to a putrid state, but, on the contrary, grow more and more acid, and to such a degree, that I compared one of them (which consisted of raw meat and bread, of each two drachms, and of an ounce of water) with a like mixture, to which were added in the beginning ten drops of the spirit of vitriol; and after both had stood some days in the furnace, I found them equally acid. To account for this, we must observe, that the addition of so strong an acid preventing fermentation, the last mixture had no more acidity than what was given to it at first by the spirit of vitriol.

12. I have also observed, that the acid arising from these processes has something of an austere and saltish taste, but without any offensive smell, unless the phials are kept close during the fermentation; in which case the smell is like that of sour milk, or lean cheese.

Now, considering how much air is generated, and how sour these mixtures are made by fermentation, it may seem strange that the same materials, used as food, should make so little disturbance in the body. And the difficulty would be the greater, did the *saliva* as some suppose, promote both fermentation and putrefaction.*

EXPERIMENT XXIX.

To ascertain the effects of the *saliva* in digestion, I added a small portion of it to some raw beef, and observed that this mixture, in the usual heat, putrefied slower than another which had no *saliva* joined to it.

EXPERIMENT XXX.

1. I took two drachms of fresh meat, the same quantity of bread, and an ounce of water, and to these added as much *saliva* as I supposed necessary for diges-

* The *saliva* is reckoned by the celebrated Stahl among those substances which are proper to excite a vegetable fermentation. *Vid. Fundam. Chym. part ii. tract. i. sect. i. cap. v.* And the same opinion has generally prevailed, as I imagine, from this circumstance: a traveller gives an account of a strange method of making a vinous liquor, in use among one of the Indian nations; that is, by first chewing the fruit, or grain, before they put them to ferment. But all that can be inferred from hence, is, that the *saliva*, without bringing on the fermentation sooner, may make it more equable and moderate after it begins, as in our experiments; and this may be a necessary circumstance for conducting that process in a hot climate.

tion. This mixture being beaten in a mortar was put into a close phial, and set in the furnace, where it remained about two days with scarce any visible fermentation; but on the third day that action became manifest. At that time I found the bread and flesh risen in the water, a sediment nevertheless forming, and bubbles of air continually mounting from it; in a word, the fermentation was complete, being also distinguished by a vinous smell, as in ordinary working liquors. The action continued above twice as long as when no *saliva* was used, and it was more moderate, and generated air with less tumult. When the fermentation entirely ceased, the mixture had a pure acid taste, though weaker than what was produced in the former experiments; and I took notice that it had no putrid smell from the beginning.

2. I likewise varied this experiment as I had done the first, by using roasted meat instead of raw, and sometimes oatmeal instead of bread; but the result was still the same. One circumstance may deserve particular notice. An ounce of bread, as much roasted meat, about two ounces of water, and a small quantity of the *saliva*, being beaten together, were allowed to ferment in a heat of sixty five degrees; and having examined the phial with a thermometer, I found it about three degrees warmer than the external air.*

From these last experiments it appears, that if the

* It is probable, that in a fermentation of this kind the heat increases in proportion to the quantity of the mixture. In so small a quantity, I doubt that neither vegetable substances fermenting, nor animal corrupting, separately, would raise any perceptible degree of heat; though vegetables alone are capable of acquiring an intense heat (so indeed as to break out into a flame) if laid in a great heap, compressed and kept moist. But in that case, a putrefaction beginning, the fermentation is carried on between the septic and the acescent parts, exactly as in the experiment above.

saliva is sound, in a sufficient quantity, and well mixed with the aliment, it is qualified for retarding putrefaction, preventing immoderate fermentation, flatulence, and acidity in the *primæ viæ*. But if that humour is deficient, unsound, or not sufficiently mixed with what is swallowed, that the aliment may first putrefy, then grow acid, and in that action ferment strongly, and in the stomach and bowels generate much air.

PAPER V.

Experiments and remarks on the fermentation of vegetables, by means of putrid animal substances, continued. An austere acid produced by such fermentations. The probability that most vegetables are fermentable; not excepting the acrid, antiscorbutic or alkalescent class. Of the fermentation of milk. How far the aliment ferments in the stomach. Of the use of the *saliva* in alimentary fermentation. Of various causes of indigestion. Of the cause and cure of the heart-burn. And from what cause a sourness of the stomach proceeds.

Read June 20, 1751.

IN my last paper, I gave an account of some observations which I had made upon the fermentation of the *farinacea*, excited by animal substances, but not having then finished that subject, I shall now lay before the society a few more experiments relating thereto.

EXPERIMENT XXXI.

After having seen the effects of the fresh *saliva*, both in keeping up and moderating fermentation, I was desirous of knowing its qualities when putrid. For this purpose having collected a sufficient quantity, I kept it about three days in the furnace,* and then added the

* *Viz.* Blood-warm, or about 100 degrees of Fahrenheit's thermometer; and the same degree of heat is to be understood as used in the rest of these experiments, unless when it is otherwise expressed.

Dr. Alston not attending to the note above (which stands in all the editions of this work) in his first dissertation on quick-lime, contradicts the result of one of my experiments, from one that he himself had made in the common air, at Edinburgh, in the end of April and beginning of May; alleging that I had not specified the degree of heat which I had used in my experiments upon the same substance.

usual proportion of it to the common mixtures of bread, flesh, and water; and this not only brought on the fermentation sooner, but made it stronger and more productive of air, than would have happened without the *saliva*. The flesh became also more than usually putrid, but at last it was sweetened by means of the fermentation; so that by the time the action ceased, the contents of the phial smelled and tasted sour, without any remains of putrefaction.

From this experiment we find it still more probable, that animal substances have a power (in proportion to their degree of corruption) of exciting a fermentation in the common *farmacea*.

EXPERIMENT XXXII.

I took two drachms of a fresh mackarel skinned, with an equal quantity of bread, and having reduced them to the usual consistence with an ounce of water, I placed them in the furnace, together with another phial containing the like mixture, but with the addition of fresh *saliva*; and a third, with the same quantities of fresh beef, bread and water only, with which the two former were to be compared. In less than five hours after infusion, the materials in all the phials began to rise, to float in the water, and to ferment; and during the whole process I perceived no difference between the fermentation occasioned by the fish, and that by the flesh, except that the phials with the fish retained the corrupted smell the longest. But next day, the fermentation still subsisting, the acid smell was to be distinguished in all the phials; and on the fourth day (the corks having been drawn the night before) I was scarce sensible of any difference between the first and the third or standard phial, either as to taste or smell,

and both were very acid. But the liquor in the second phial was not so sour, and it yielded such a vinous smell as was taken notice of before, when the fresh *saliva* was added to the common mixture with the beef.*

Having therefore observed, in this instance, such an exact agreement between the powers of fish and of flesh in causing fermentation, and presuming that all fish possessed more or less of the same quality, I did not repeat the experiment with any other sort. For though I was sensible, that for the better regulation of diet, and rightly understanding the different effects of different animals in food, it might be of use to examine in this manner, many of the individuals, and to observe which of them were more, or less apt to cause fermentation, and produce more or less of an acid; yet, as such inquiries would have taken up too much time, I omitted them for the present, and pursued the general point, of inquiring how extensive this principle, of exciting fermentation, was among other animal substances.

EXPERIMENT XXXIII.

I therefore made a trial with the yolks of new-laid eggs. One of these I mixed with two drachms of white bread and an ounce of water; and another, with the same proportion of bread and water, to which I added some *saliva*. But though both phials were kept four days in the furnace, I could perceive no marks of fermentation, or any tendency to putrefaction in either. Whereupon recollecting M. de Reaumur's observation, about the slow putrefaction of unimpregnated eggs, I concluded that either these two happened to be

* Exper. xxx.

so, and therefore resisted putrefaction so much the longer, or, which was most likely, that by a small degree of acidity in the bread, they had been wholly preserved from corrupting, and, of course, from fermenting too. So that this experiment ought to make no exception to the general principle, that all animal substances, upon putrefying, excite a fermentation in the *farinacea*.

EXPERIMENT XXXIV.

Having remarked, that the liquor produced by all the fermentations had not only a sour but an austere taste, in order to be sure that this did not proceed from alum (which the bakers have been accused of mixing with their loaf bread) I made a like trial with sea-biscuit; but that yielded the same kind of astringent acid as the other; and, as I remember, oatmeal afforded an acid little different from the rest.

Having shown how fermentable some of the *farinacea* are, by means of corrupted animal substances, and how probable it is, that the rest of that class agree in the same quality with the specimens, I shall next relate some experiments which I made upon vegetables, of a different kind.

EXPERIMENT XXXV.

Into one phial, I put two drachms of fresh beef, with a handful of new cut spinage, and two ounces of water. Into another, the same quantity of flesh, half an ounce of boiled spinage, and between two or three ounces of water. In a third phial, was the same weight of the meat, with half an ounce of fresh asparagus, and two ounces of water. In a fourth, was the like mixture, but with the asparagus boiled. The fifth contained the

same quantity of beef, with a handful of garden scurvy-grass, and two ounces of water. The sixth and last phial served for a standard, with a mixture of beef, bread and water only. All these were reduced to a pulp, as usual.

In less than five hours after setting them in the furnace, I found, not only the standard, but the contents of the two phials with the asparagus in a fermenting state. The motion was particularly brisk in that with the raw plant; but in both, the fermentation went higher, and generated more air than the standard. In other respects the action was the same; for the flesh acquired at first a putrid smell, and afterwards lost it; and the next day, or about thirty hours after infusion, the acid prevailed; which, though considerably less than that of the standard, yet was sufficient for curdling milk. But the greatest difference between the fermentation of the asparagus, and that of the bread, lay in this, that after the bread-mixture became sour, it remained so; whereas the acidity in the asparagus-mixture was so weak, that in two or three days afterwards, it was entirely overcome by the corruption of the meat.

The process with the spinage was little different: it fermented about an hour later than the standard, and the raw plant somewhat later than the boiled. The fermentation of both was more moderate than either that with the asparagus or bread; less air being generated, and in a less tumultuous manner. At the same time that the standard became acid, this change was also distinguishable in the phials with the spinage, by its curdling milk: but after this period, as was remarked of the asparagus, both the spinage-mixtures became putrid.

The scurvygrass also fermented, and as early as the standard, but more moderately and with less flatulence. Its acid was ascertained by the same test with

the former, *viz.* by curdling milk; but herein it differed, that after this change it continued to preserve the meat longer from corruption. By which it appears, that though this plant is without any manifest acid, it is nevertheless a pretty strong resister of putrefaction.

I took the more notice of the fermentation of the scurvygrass, as being of a class supposed unfermentable; and therefore I repeated the experiment, but with the same result. And since these trials agree with the common observations upon the virtues of this plant, in the marine or marsh-scurvy, it may therefore seem improperly classed with such medicines as correct acidities, and promote putrefaction.* As for the asparagus and spinage, though they contain but a weak acid, yet being fermentable, and in some degree resisters of putrefaction, neither can they be deemed septics, but, at most, vegetables of easy corruption. The readiness with which the asparagus ferments seems to correspond with the quickness of its digestion in the stomach. For, from all the experiments which I have made, I am induced to think, that such vegetables as are of the easiest digestion will fall into the speediest fermentation in a blood-warm furnace. Yet excepting these mentioned, I have made trial of no other esculent plants since I discovered their property of fermenting with corrupted flesh. But I remember, when, for some other intention, I had once made a pulp of flesh, water, and turnip, and left it in the furnace, without minding it for two or three days, that the liquor then tasted sour; which I presume would not have happened without a previous fermentation. Hence I conjecture, that all the alimentary plants, which are

* The sea or marsh-scurvy appears to proceed from a putrid acrimony, as the livid blotches, offensive breath, and resolution both of the blood and fibres testify.

not too bitter, or too spicy, will ferment much in the same manner with those mentioned: and I am almost confirmed in this opinion by the following experiment.

EXPERIMENT XXXVI.

1. To an ounce of new-milk were added some drops of the *crassamentum* of human blood resolved by putrefaction, and the phial with this mixture being exposed to the usual heat of an hundred degrees, in a few hours the contents fermented. The intestine motion was considerable, much air was separated, and an acid was produced, which curdled the milk, and corrected the putrid smell.

2. The experiment was repeated with four ounces of milk, and about two drachms of the corrupted blood; and after six or seven hours quiet infusion, a strong fermentation ensued, by which the glass stopper was forced out, and the froth came over, though the bottle was little more than half full. Now, since milk may be considered as the juice of grass and various other vegetables, but little assimilated into an animal nature, we may from hence judge how prone all vegetables are to ferment with any thing putrid.

There being so great a similarity between the contents of the phials, in most of these experiments, and the aliment in digestion, it is scarce to be doubted, that a fermentation is begun in the stomach, as often as there is any animal substance to serve for a ferment, and vegetables to be fermented.

That the aliment ferments in the stomach, has been the opinion of some of the ancients as well as the moderns; but as till now, it was not known what share animal substances, beginning to putrefy, had in promoting that process, and that a mixture of animal and

vegetable food spontaneously fermented, it is no wonder that their theory was wholly rejected by some, and admitted by others with many restrictions. Nor will I infer from these experiments, that this fermentation is either universal or indispensable; since many live better on a vegetable than on an animal diet. And though in such cases the vegetables may be supposed to ferment with the *saliva*, it is plain that this action must be inconsiderable, or at least fall short of what results from an addition of animal food. But then we may observe, that without milk, vegetables alone afford but a poor nourishment; and that such as join milk to their vegetables, have therein an animal fluid already somewhat prepared. Again, that those with whom a vegetable diet best agrees, are either of a hectic, or a scorbutic, that is, of a putrid habit; in which condition the *saliva*, being in a corrupted state, may induce that change upon the aliment, which in better health, would be effected by the beginning putrefaction of animal food in the stomach. Without these circumstances, a vegetable diet will be digested most easily by those who by hard labour are able to subdue the viscosity of unfermented chyle. This is the case of the common people in the poorer countries, who subsist chiefly on the *farinacea*, and eat no flesh. But whenever such, by age or infirmity, are obliged to leave off work, they become subject to indigestions; and, upon the whole, seem to be less healthy, and are shorter lived, than those who are nourished on a mixture of animal and vegetable substances.

It has been remarked, that the fermentation begins in the phials between four and five hours after infusion; but this we are to understand of the manifest fermentation only; for as to the insensible working of those mixtures, it must be allowed to take place much

sooner, and probably from the time they are first set in the furnace. Agreeably to this notion, we presume, that after every meal a fermentation is begun, and is so far carried on in the *primæ viæ*, that before the chyle enters the lacteals, its particles become as dis-united, and the air as much loosened as in the phials, when the bread and flesh first change their specific gravity and float in the water. But we do not pretend, that in a natural state this ever rises to a vinous or an acetous fermentation, being assured that the chyle is admitted into the blood before it undergoes so considerable an alteration.

We have seen the use of the *saliva* in moderating fermentation, and continuing it longer; and also in checking the too great propensity of animal substances to putrefaction, and that of vegetables to acidity. Now, when the *saliva* is sound, and in sufficient quantity, and the aliment well prepared, and not too much of it, the fermentation passes without any tumult, and generates but little air. But in surfeits, or upon swallowing without due mastication; when meats are tough, or fat, or eaten with farinaceous substances unfermented; or when by any accident the *saliva* is vitiated, too small in quantity, or not intimately mixed with the food, the fermentation becomes tumultuous, the stomach swells with air; and this great commotion being attended with an unusual heat, brings on that uneasiness called the *heart-burn*. And as in the experiments, a certain quantity of the *saliva* was found requisite for keeping the fermentation within bounds, so in practice we find, that whatever promotes a greater secretion of that humour, or helps to mix it with what we eat, is the best remedy for such indigestions.

3. If any oily substance is added to the common mixture, a stronger fermentation ensues, which can-

not be moderated by the usual proportion of the *saliva*, till some fixed alkaline salt be added, as I found upon trial. And as I have also observed, that these salts will, without the *saliva*, not only suddenly check the high fermentations in the phials, but likewise suppress them for some time, it is no wonder that they should be so sure and speedy a remedy in the heart-burn; as they not only render the *saliva* more saponaceous, but suspend the fermentation till more of that humour can be secreted, and mixed with the aliment.

The theory resulting from these experiments may help to account for other disorders of the stomach; but I shall attempt to explain only one more at this time: And that is the *sourness* of the stomach, from a liquor sometimes so acrid as to excoriate the throat, and to set the teeth on edge. In order to learn the cause of this extraordinary acidity, I made various experiments upon our common food; and among others, I made several infusions of bread in water, in different proportions, which after keeping some days blood-warm, in the furnace, became but little acid, and still less so when the *saliva* was added. And as to flesh, so far is it from turning sour, that its corruption seems directly opposed to acidity. Nevertheless it is certain, that many will suffer from an acid, though living on flesh, bread and water only. Now, from the common theory of digestion, we shall hardly be able to account for this matter; but easily from the principle of fermentation; by which we find, that not only a strong, but an austere acid, may be produced from these very materials, as often as the stomach is relaxed, or any way disabled, from conveying the whole aliment into the intestines. For what is left in the stomach having time to undergo a complete fermentation, is thereby changed into a harsh sort of vinegar.

PAPER VI.

Experiments upon substances, hastening, retarding, increasing and diminishing alimentary fermentation, with remarks upon their use in explaining the action of digestion, and showing how that may be occasionally assisted by acids, bitters, aromatics, wine, &c. What substances come nearest to the *saliva* in its digestive quality, and how these are to be varied according to the habit. Of the difference between the action of the bile and that of common bitters. Sea-salt, in different quantities, either promotes, or retards alimentary fermentation; but the other septics always hasten that process. In what properties the *testacea*, lime-water, and the fixed alkaline salts agree, and differ. What aliments are the easiest, and what the hardest of digestion.

Read October 31, 1751.

HAVING in the two preceding papers laid before the Society some experiments, setting forth the general fermentation of alimentary vegetables, by means of animal substances tending to putrefaction, or already putrid, I shall now finish that part of my subject, by reciting some others which I have made upon bodies, which either hasten, or retard, increase, or diminish that process; and I shall endeavour, as before, to apply those experiments to medical cases.

EXPERIMENT XXXVII.

1. To two drachms of fresh beef, and as much bread were added red port-wine, and water, of each half an ounce. To the same quantity of bread and flesh, in another phial, was put an ounce of common small-beer. In the third phial, the bread and flesh were diluted with an ounce of water, acidulated with a few drops of the spirit of vitriol. And in the fourth phial were the same materials; only, instead of the spirit of vitriol, I put two

drachms of the acid liquor arising from a fermentation of bread, flesh, and water. All these mixtures being reduced to the usual consistence, were set in the furnace, where they remained three days, without generating air, or affording any signs of fermentation. But two teaspoonfuls of rum being added to the common mixture, retarded fermentation for some hours only: perhaps a double or triple quantity would have wholly suppressed it.

2. In one of the common mixtures were infused five grains of the *species aromaticæ* of the London Dispensatory; in another, ten grains of cumminseed; a third, had half a drachm of the filings of the wood of sassafras; a fourth, five grains of saffron; a fifth, five grains of myrrh; and a sixth, five grains of aloes. In the two last the substances were dissolved; but in all the rest, the infusions were made in boiling water, and when cool, added to the bread and flesh beaten to a pulp, as in the former experiments. Besides these, another phial with the common mixture was prepared for a standard, with which the rest were to be compared, in relation to the manner, time, and degree of their fermentation. Things being thus disposed, and the phials placed in the furnace, I observed the fermentation to begin in them all much later than in the standard, that with the sassafras excepted; but with this difference among them, that the mixtures with the aromatics, especially that with the sassafras, fermented strongly and generated more air than the standard, whilst those with the saffron, myrrh and aloes, fermented slower, and were less flatulent.

3. In the same manner I examined the tops of wormwood, and the lesser centaury, camomile flowers, gentian-root, and green tea; making moderate infusions of all except the last, which was strong; and I perceived that these also retarded fermentation considerably; the

camomile and wormwood most; and that all of them, like the former bitters, moderated the fermentation; though none of them nearly so much as the *saliva*.

4. I found the same effect in strained decoctions of the wild valerian-root, and of the Peruvian bark. But when the decoction of the last was left unstrained (*i. e.* with more of the substance in it) the fermentation became then much higher than in the standard. Whereupon recollecting the like high fermentation of sassafras, and what is said of the fermentation of the Thames-water, in oaken casks,* I imputed these greater commotions to the aptness which all wood has to increase fermentation, when infused with any thing putrid. But however that may be, it is likely that this fermenting quality of the bark is the cause of its disagreement with weak stomachs, when taken in substance, and in large doses.

5. In like manner I examined horseradish, mustard seed, and garden scurvygrass, as specimens of the hot alkalescent plants, and observed that the first, like the bitters, suspended the fermentation long; the mustard, a little while; but the scurvygrass, not at all. And I took notice, that these mixtures not only fermented more moderately than the standard, but also less than any of the substances before mentioned; and therein approached nearer to the nature of the *saliva* than any thing yet tried. Lastly, I observed both of the bitter and acrid

* The aptness in the Thames water first to ferment, and then to become pure, in long voyages, is well known; but it is probable that this quality is owing to the great quantity of putrid matter with which it is impregnated, at the place where it is taken up, *viz.* a little below London bridge. As I have never heard of this, or any other water, fermenting but in wooden vessels, we may conclude that a vegetable juice is a necessary ingredient. Oaken casks are particularly noted for promoting the fermentation of common vinous liquors.

plants, that after a complete fermentation, the acid thereby produced was sensibly milder than that in the standard.

From these experiments it seems probable, that spirits, acids, bitters, aromatics, and the hotter antiscorbutic plants retard fermentation by their power of correcting putrefaction; and that since putrefaction and fermentation are such requisites in digestion, whatever opposes those processes must be contrary to that action. But as, by means either of putrid *saliva*, or from a defect of that humour, the aliment may ferment too strongly; or by a debility of the stomach, the food may be detained too long in it, and ferment too much, the acids, bitters, aromatics, wines, &c. may have their several uses; some for checking immoderate fermentation, and others for bracing the stomach, and enabling it to expel its contents in due time.

Fermentation being wholly suppressed in the phials by small-beer, wine and acids, may seem to prove that this process would not take place in the stomach during the free use of such liquors. But here we must observe, that the experiments mentioned were made without any *saliva*; for, when new trials were made with a sufficient quantity of that humour, the same materials then fermented well, and only somewhat later than in the standard. Again, when the putrid *saliva* was used, so far were the acids from being of disservice, that they were evidently useful in preventing the more violent fermentations which the corrupted humour would have then produced.

But whenever the recent *saliva* was overpowered by the acid, the fermentation was then to be promoted by correcting that acid, either by an alkaline salt, or by the testaceous powders.

Do not these facts correspond with digestion? For

the most nourishing and digestible food, to people in health, consists of a due mixture of animal and vegetable substances with water. Scorbutic or putrid habits require acids, wine, or other antiseptics. An acid abounding in the stomach is corrected by absorbents; and in a want of natural heat, or in a debility of the stomach, wines, bitters, warm and acrid substances become necessary for bracing and stimulating the fibres.

Since one great use of the *saliva* is to moderate fermentation, it is probable that such substances as resemble it most in this quality will prove the best stomachics, upon the failure of that humour. Of this class are acids, spirits, and bitters; but seeing that all these much retard, as well as moderate fermentation, they may be frequently less proper than some of the antiscorbutics, which, as we observed, stopped fermentation little, and yet kept it most within bounds*. And as to the aromatics, however assisting they may be in digestion, by their heat and *stimulus*, they promise less of a carminative quality than either the bitters, or antiscorbutics, in as much as they are more disposed to increase than to moderate fermentation, and consequently to produce air, instead of suppressing it.

EXPERIMENT XXXVIII.

BEING desirous of comparing the effects of bile with those of bitter plants, I made trials with fresh sheep's gall, but found the result different from the common opinion, about the agreement between an animal and vegetable bitter. For having added a portion of the gall to a mixture of flesh, bread and water, and made a standard of a like mixture without the gall,

* Such as mustard, and garden scurvy-grass: see page 360.

I perceived the fermentation to begin in both about the same time, but to be much stronger, and more tumultuous in the former than in the latter. Nay, so little was the gall disposed to restrain fermentation, that without any other animal substance it fermented with bread and water only, as mentioned in a former paper. Now, since vegetable bitters are antiseptic, retarders, and moderators of fermentation, they must therefore influence digestion very differently from the bile, which is possessed of all the opposite qualities. This being the case, we cannot be surprised at finding digestion so little mended in the jaundice by bitters, which are commonly given to supply the defect of the gall. Yet there is one quality in which the animal and the vegetable bitters may agree, *viz.* that of correcting acidity; for I took notice, that though the bilious mixtures lost their usual rankness, acquired in the beginning of the fermentation, yet they never smelled nor tasted sour after it had ceased.

EXPERIMENT XXXIX.

Upon adding sea-salt to the common mixture, I observed, that the same quantity, which proved septic in the former experiments, made the fermentation begin sooner here than in the standard; but that a larger quantity retarded it. Thus, two drachms of bread, with as much flesh, two ounces of water, and ten grains of sea-salt, fermented somewhat sooner than a like mixture without salt; but when the salt was increased to half a drachm, the fermentation came on later than usual.

But salt of wormwood, and ley of tartar, always retarded fermentation, and that in proportion to their quantity. I tried no other salt, being persuaded, that all the rest (in any proportion) would resist fermentation, as being all thoroughly antiseptic.

EXPERIMENT XL.

A few grains of prepared crabs-eyes, added to the common mixture, brought on the fermentation above half an hour before the standard, and made it greater. The flesh also became ranker than usual; yet it was at last sweetened by the acid produced in this process. But when twenty, or thirty grains of the powder were used, the fermentation came on still earlier, and was more violent; and the flesh becoming once putrid, never recovered its sweetness.

The effects of lime-water were different, as it neither hastened the fermentation, nor made it so strong as above; the motion however was brisk, and when it ceased, the liquor was neither acid nor putrid, but had an agreeable smell like that of new bread.

Thus, the *testaceá*, lime-water, and fixed alkaline salts, agree in some things, but differ in others. For both putrefaction and fermentation are resisted by the salts, but promoted by the *testacea*; whereas lime-water neither retards fermentation, like the lixivial salts; nor hastens it, nor makes it so violent as the *testacea* do; and being at the same time somewhat astringent, becomes a good medicine for weak stomachs with a predominating acid; as several have experienced who were subject to the gout, gravel, and other chronic diseases, seemingly depending on that cause.

EXPERIMENT XLI.

Alimentary animal substances, tending to putrefaction, are all likewise promoters of fermentation, so far as I have inquired. Thus, flesh kept till it becomes tender, though still sweet, is a readier ferment than the

same kind used quite fresh. But though the fermentation is, by the keeping, sooner excited, yet it does not thereby become the stronger. Flesh pounded in a mortar ferments sooner, and with less tumult, than the same does in a lump, or not thoroughly bruised; and raw meat ferments less quietly than roasted. All which circumstances are agreeable to common observation, *viz.* that meats are better digested when kept till they are tender, when well dressed, and sufficiently chewed; and seem to prove, that whatever is slow to corrupt, will, *cæteris paribus*, also sit heavy on the stomach.

Of all animal substances, eggs are among the slowest to corrupt, and of course are among the slowest to excite fermentation. Hence a new-laid egg, for its bulk, should be of all tender animal food among the heaviest; and yet the same substance, from another theory, respecting the nutrition of the chick only, has been thought the lightest of any.

PAPER VII.

Experiments and remarks upon the putrefaction of blood, and other animal substances. Of the nature of the inflammatory crust or the sily part of the blood. Of the fæcal acid. Uses drawn from observing the colours of corrupted blood. Of the nature of purulent matter. The resolution of the blood, the relaxation of the fibres, and the emission of air, are the consequences of putrefaction: hence several symptoms of putrid diseases accounted for. The marrow not soon corruptible. The blood may become sensibly putrid whilst the animal lives. The different action of alkaline salts, and of putrid substances, upon the nerves. That there is but one species of the true scurvy; and that this arises from putrefaction.

Read February 23, 1752.

HAVING in my last paper finished that part of my subject, which relates to the vinous fermentation of vegetables, excited by a putrid ferment, I shall conclude the whole with subjoining a few experiments made upon the putrefaction both of the blood and of the more solid parts of the body, with a view to clear up some other points in the theory of medicine.

EXPERIMENT XLII.

A PORTION of blood, taken from a man ill of a pleurisy, was divided into the inflammatory crust,* the *crassamentum* and the *serum*. These were put into different phials, of a larger size (so as to contain a good deal of air) and being corked, were placed in the furnace, heated to the common standard, *viz.* 100 degrees of Fahrenheit's thermometer. In twelve or fourteen hours the crust began to corrupt, the *crassamentum* held out a few hours longer, but the *serum* continued

* *Viz.* that part of the blood, which M. De Senac calls *la matiere blanche, qui se coagule d'elle même.* Structure du Cœur, tom. ii. p. 91.

near four times longer than this last without any offensive mark of putrefaction. This experiment was repeated with some fresh pleuritic blood, taken from another person, and with the like success.

2. Another time, having procured blood with a thick inflammatory crust, I separated that part of it from the rest, and dividing it into two, I exposed one piece to the air, in a room; and the other, I kept in a saucer, and covered it with a cup. The experiment was made in summer; and I observed, that the former piece (which at first weighed two drachms) lost half its weight in twenty-four hours, by evaporation only; and that in two days more, the whole was reduced to a thin pellicle; but that the covered portion, in a few days, ran *per deliquium*; whilst one part of the *crassamentum* (that had likewise been left to evaporate, but upon the outside of a window) formed itself into a thick cake; and the rest of that substance, which had been kept in a close phial, retained for some weeks a considerable degree of cohesion.

The inflammatory crust being therefore so soluble, volatile, and corruptible, may we not conclude that it contains a greater quantity of septic particles than any other part of the blood? How this comes to pass, I shall now endeavour to explain.

Whether inflammatory fevers are first brought on by the shutting up of the pores of the skin, or by some other cause, has been a question; though it has never been doubted, that a stoppage of perspiration is, at least, the consequence of such fevers; and therefore it follows, that in either case, the most corrupted particles must be retained, at a time, when, from a greater degree of heat, the humours are most disposed to putrefaction. But when after bleeding, the blood is allowed to stand till the homogeneous parts have time

to unite, the perspirable and septic matter immediately flies off from the *serum*, as least viscous; but adheres to the *crassamentum*; and is still more entangled in the sily or glutinous portion of the blood that rises to the surface.

EXPERIMENT XLIII.

Mineral acids being such powerful antiseptics, I was desirous to see their effects upon substances already putrid. For this purpose, I dropped some spirit of vitriol both upon a bit of corrupted beef, and upon the *crassamentum* of human blood, also putrid; and I observed, that this acid, instead of allaying the *fætor*, rather increased it; so that by this addition it became stercoraceous, or acquired such a smell as arises during the precipitation of sulphur (by an acid) in a lixivial *menstruum*.*

Having repeated the experiment both with the spirit of sea-salt, and vinegar, with the same result, I from thence began to conjecture, that the *effluvia* issuing from corrupted substances consist chiefly of the *phlogiston*† or sulphur principle; since these *effluvia* so readily unite with, and volatilize the acids, as appears by the increase and particular change of the smell. But it will be proper to remark, that from a simple putrid substance, the *phlogiston* does not rise alone, but united with the saline parts of the body.

* Sciendum vero, sulphur solutum alcalicis, dein misto acido, præcipitari, albescere, *fætorem ingratißimum putrefactorum excrementorum* exhibere. Si tincturæ aureæ sulphuris acetum instillas, mox *fætor* prodit *stercoreus* ex præcipitato sulphure. *Boerhaave Element. Chem. tom. ii. proc. clix.*

† Materiam et principium ignis, non ipsum ignem, ego *phlogiston* appellari cœpi; nempe primum ignescibile, inflammabile, directe atque eminenter ad calorem suscipiendum atque fovendum habile principium. *Stahl's Fundam Theor. Beccherian.*

For the *phlogiston*, when single, is perhaps imperceptible to the smell; and when divested of these salts, is never, so far as we know, pestilential. So that the deleterious particles of putrid substances seem to consist of a certain combination of the sulphureous with the saline principle, which not only becomes the most irritating *stimulus* to the nerves, but acts upon the humours as a ferment, in promoting their corruption.

From the same experiment, it seems likewise probable that the *fæces humanæ*, to which this mixture (made between the putrid substance and an acid) has a near affinity, are compounded of some strong acid and corrupted matter; and consequently, that in a natural state the *fæces* are little, if at all, infectious; which could not happen were they wholly putrid.*

EXPERIMENT XLIV.

After the acid was added, in the manner described in the last experiment, I attempted to restore those substances to their former putrid state by an alkaline salt. But upon instilling the ley of tartar (which was followed by the usual effervescence) I perceived, that the mixture became thereby much less offensive than when the putrid substance was either alone, or joined to the acid; a circumstance which I did not expect. But from hence, perhaps, we may be able to account for the virtues of the saline draughts of Riverius, taken in the act of effervescence, and first recommended by that author in vomitings incident to putrid and malignant fevers.†

* See preceding observations part iii. ch. vii.

† River. cap. de Feb. Pestilent.

EXPERIMENT XLV.

In order to examine the colour of the different parts of corrupted blood, I procured a fresh quantity without any inflammatory crust, and divided it into the *crassamentum*, the *serum*, with a few red globules that fell to the bottom, and the pure *serum*. The phials containing these several liquors were set in the furnace, where they stood some days till they became thoroughly putrid.

The *crassamentum* changed from a deep crimson to a dark livid colour; so that when any portion of this was diluted with water, it appeared of a tawny hue. Of the same colour was that *serum* in which the red globules had been dissolved. But the pure *serum*, after becoming turbid, dropped a white purulent sediment, and changed into a faint olive green.

From this experiment it should seem, that the *ichor* of sores, and that of dysenteric fluxes, consists of the *serum* tinged with a small quantity of red blood putrefied; and that when the serous vessels are of a tawny cast, we are not always to refer that colour to inflammation, but to a solution of some of the red globules mixed with the *serum*. An instance of this may be seen in the colour of the white of the eye, in putrid scurvies, and in the advanced state of malignant fevers. At such times, not only the *serum* of blood drawn from a vein, and that which oozes from a blister, but even the *saliva* and sweat will be tinged in the like manner.*

To the recent urine of a person in health, were added a few drops of this putrid *crassamentum*, which it im-

* See the preceding observations, page 176.

mediately changed into a flame-coloured water, so common in fevers and in the sea-scurvy. After standing about two hours, it gathered a cloud, resembling what is so often seen in the crude urine, in fevers; and I took notice of a speck or two of an oily substance on the surface, like that scum which is said to appear in putrid scurvies.

As to the green *serum*, it is perhaps never to be seen in the vessels of a living body; since in all disorders, the red globules being resolved, enter the serous vessels; and when the *serum* is thus coloured, it never can become green. Besides, as this humour is late in acquiring that cast when out of the body, it is not to be supposed that a person could survive so great a change in his blood. But in dead bodies, this *serum* is to be distinguished by the greenness which the flesh acquires in corrupting. In salted meats, we commonly ascribe the greenness to the brine, but erroneously; for salt has no power of giving this colour, but only of qualifying the taste, and correcting the bad effects of corrupted aliments, in some degree. This colour, in dead bodies, begins first in the intestines, and in the parts adjoining, from the air in the *primæ viæ*, which hastens the putrefaction.

In foul ulcers, and in other sores, where the *serum* is left to stagnate long, the matter is likewise found greenish, and then it is always acrimonious. But the effects of a green *serum* are no where so much to be dreaded as in the case of an *ascites*, where it is often collected in a large quantity. Of this we have, in the transactions, a remarkable instance in Mr. Cox, surgeon at Peterborough, who upon tapping an hydropic woman, but a few hours after her death, was so affected with the steams of the water, which was of a green

colour, that he was presently seized with a pestilential fever, and narrowly escaped with his life.*

I have already observed that the *serum* of human blood, upon standing but a little time in the furnace, becomes turbid before it grows offensive, and then gradually drops a sediment resembling digested matter. This experiment was also frequently repeated with the same success; and I likewise took notice, that this matter never changed its colour, or mixed again with the *serum*. From these circumstances I conjecture, that this sediment is a terrestrial substance, intended for the nourishment or reparation of the solids. And I am the more inclined to this opinion, upon discovering a like sediment in the urine of people in perfect health, after long standing; as I consider this last as either the redundance of the nutritious matter, or what has been actually applied, but ceases to be of any longer use.

May we not therefore conclude, that the *serum* is perpetually oozing into ulcers; but that from the heat of the part, and the natural volatility of animal fluids, it is all quickly evaporated, excepting this matter, that remains in the sore in the form of *pus*, and which is so requisite to the cure? For this reason, are not large ulcers weakening, from the great expense of blood in furnishing as much *serum* as is necessary, upon evaporation, to leave a sufficient quantity of this substance? And are not issues upon this account of more consequence for making drains, than one would expect from the visible discharge? As near as I could guess, an ounce of *serum*, upon standing some days, did not furnish more of this matter, than what might be produced by the daily running of a good issue, or that of a seton.

* Philos. Transact. n. 454. p. 168. Abridg. vol. ix. part iii. ch. v. art. viii. p. 212.

EXPERIMENT XLVI.

As all the humours become thinner by putrefaction, so the solid or fibrous parts of animal bodies are relaxed or rendered more tender by the same process. This observation is so common, and uncontroverted, that it requires no new experiments to confirm it. I shall therefore only remark, that this state seems to be one of the clearest cases of a disease depending on weak and lax fibres, as may be seen in all malignant fevers, and in the true sea or marsh-scurvy, which arises from a putrid cause.

From this circumstance, are we not enabled to account for the extraordinary bulk of the heart, liver, and spleen, the common effects of these diseases? For supposing the natural growth of the parts stopped by the rigidity of the fibres, balancing the distending force of the blood, it will follow, that whenever the fibres are preternaturally softened, the increase of the same parts will begin anew.* Of this fact, we have some remarkable instances in those who died of the last plague at Marseilles (communicated to the society by M. Didier, one of the physicians to the king of France†) which, with others of the same sort, have been since republished in a large collection of papers relating to that fatal distemper.‡ It is observable, that in nine dissections, there referred to; the extraordinary growth of the heart is mentioned in all, and that of the liver in seven of them. Thus, in the first, the author takes notice, that “The heart was of an extraordinary bigness,

* This conjecture I had from Dr. Thomas Simpson, professor of medicine in the university of St. Andrews.

† Phil. Transact. n. 370. Abridg. vol. vi. part iii. ch. ii.

‡ Traité de la Peste.

“the liver was of double the natural size.—Case 2.
 “The heart was of a prodigious bigness, and the liver
 “much enlarged.—Case 3. The heart of double the
 “natural bigness.—Case 4. The heart was very large,
 “and the liver was bigger and harder than ordinary.
 “—Case 5. We found the heart of a prodigious big-
 “ness.—Case 6. The heart was larger than in its na-
 “tural state, the liver also was very large.—Case 7.
 “The heart was of a prodigious size, and the liver was
 “very large.—Case 8. We found the heart much
 “larger than natural, and the liver of a prodigious
 “size.—Case 9. The heart was double the natural
 “bigness, and the liver was larger than ordinary.”

As to the scurvy, Eugalenus, a noted author on that disease, observes, that the liver and spleen were often so much enlarged that the tumour could be seen outwardly.* And M. Poupart, who opened a great number of those who died of that distemper, remarks, that in all those who went off suddenly, he found the auricles of the heart as large as a man's fist, and full of coagulated blood.†

With regard to the corruption of dead bodies, an eminent anatomist, who had made an uncommon number of dissections, informed me: “That the *viscera*
 “and muscles of the *abdomen* corrupt sooner than any
 “other part of the body, after death; and therefore it
 “is a rule with anatomists to begin their dissections
 “and demonstrations with those parts which first be-
 “come offensive. That the quick putrefaction here
 “may be ascribed to the air included in the intestines,
 “or to the putrid steams of the *fæces*, especially in a

* Lib. de Morbo Scorbuto art. xxxi. Conf. Mead Mon. & Præc. Med. cap. xvi.

† Mem. de l'Acad. R. des Sc. A. 1699.

“ morbid state: hence also the speedy corruption of
“ the muscles *psaos*, and *iliacus internus*, in compari-
“ son of the muscles of the extremities. That next to the
“ abdominal *viscera* and adjacent parts, the lungs are
“ commonly the soonest tainted; whether from the air
“ stagnating in the *vesiculæ bronchiales*, or from some
“ remains of the perspirable matter, that may act as a
“ ferment and hasten the putrefaction. For that who-
“ ever tries the experiment, of compressing the *thorax*,
“ in a body that has been dead for some time, will be
“ sensible of the putrid state of the lungs, by the offen-
“ siveness of the air that is forced out of them. That
“ the brain ought to be dissected as soon as can be con-
“ veniently done after death; because in its firmest
“ state, it is but an indifferent subject for the knife,
“ and altogether unfit for dissection when resolved by
“ putrefaction; but that in several cases it has been
“ found unexpectedly firm after being kept some time,
“ and as sweet as any other part of the body. Lastly,
“ that this difference is observable between the brain
“ and the other parts, that when the brain is kept in
“ the open air, its putrefaction seems thereby rather
“ retarded, and it acquires a dry glossy skin on its out-
“ side; whereas all the other parts corrupt manifestly
“ the sooner for being exposed to the air, and get a
“ covering of a putrid *mucus* all over their surface.”*

* Dr. Hunter, who favoured me with this account, added, that as he had never given a particular attention to this subject, he could only offer what is above as the result of his best recollection.

EXPERIMENT XLVII.

The marrow is commonly accounted a substance the most offensive when corrupted; perhaps for this reason only, that carious bones are more fetid than other sores. But however that may be, I am apt to think, from the following experiment, that in general the marrow must putrefy very slowly. I put an equal, but a small quantity of ox's marrow into two large phials; to one of which I added prepared crabs-eyes. These phials being corked were set by a fire, kept all the day to a heat sufficient for liquefying the marrow, (that is, above the hundredth degree of Fahrenheit's scale) and continued there near five weeks. Yet, at the end of this time, I could perceive nothing offensive in the phial with the pure marrow, and the other smelled only a little rancid.

From this experiment, one should believe, that the *fætor* of a carious bone is not to be attributed to the marrow; since the corruption of that substance inclines more to the rancid than to the cadaverous smell: and therefore I would refer that rankness of smell to one of the two following causes, or to both of them joined. The first may be the porousness of the bone, which retains the corrupted matter longer than an ordinary sore. The second, the more constant oozing of vessels conveying the red blood; for, when these are broken, in a bony substance, they do not contract so soon as in a common ulcer; and we have seen that the red part of the blood admits of a higher degree of corruption than the serous.

EXPERIMENT XLVIII.

It is well known, that, as flesh, so blood is specifically heavier than water; and that dead bodies float, after lying some time at the bottom, by means of the fixed air separated in the bowels by putrefaction. But I have observed, that a bit of meat, beaten in a mortar to the consistence of a pulp, put into a phial with water, and set in the furnace (as in the foregoing experiments) after remaining a few hours at the bottom, floated before it became offensive; though after it rose, the corruption was soon perceptible. Here it is probable, that the particles of air, incorporated with the animal substance,* begin to be disengaged, and to be so collected together as to buoy up the flesh, though, at this time, there are scarce any air bubbles to be seen with the naked eye adhering to it.

Further, I have observed, that both the *crassamentum* and the *serum* of human blood have yielded air (after standing some time in the lamp-furnace,) before they smelled offensively. This was easily discovered by the accumulation of air in the phials; for in that small heat, the inclosed air, where there is no animal substance, is scarce sensibly dilated.

But upon the thorough putrefaction of animal substances, a considerable quantity of air is generated; and this being a fact so well known, I need only add, that I have constantly observed, that more air is produced from flesh than from blood; which is likewise a circumstance agreeable to the experiments of the rev. Dr. Hales.†

* Hale's Veget. Stat. ch. vi.

† Vide loc. cit.

Now, as I could be assured, that the blood and other animal substances, at the time they began to admit air, were not so far advanced in the septic process, as they are often found in some putrid diseases, I was induced to think, that several symptoms in the true scurvy* might be owing to the action of the air, within the vessels, either wholly detached from the humours, or but imperfectly incorporated with them; though I was aware of an objection, that might arise from the experiment of injecting air into the veins, by which animals are said immediately to die with convulsions. For all that we can infer from thence, is, that more air is thrown in than is consistent with the circulation; and that if there were less of it, the animals might survive; though perhaps not without some irregular motion of the blood, faintings, a palsy, or other affections of the nerves, in proportion to the quantity of the air injected. In fact, we find some of the most accurate naturalists allowing, after trial, that air may be conveyed into the veins slowly, and in a small quantity, without killing the animal.† And this is further confirmed by the experiments made upon animals, inclosed in an exhausted receiver, which swell all over, and are thrown into convulsions, as soon as the air is

* By the *scurvy*, I always mean the disease of sailors, or of those who live in a moist air, eat salted provisions, have little milk or greens, and drink bad water, and little or no fermented liquors.

† *Vena nempe jugularis vivi canis inflatur, protinus coagulatur sanguis, et cita mors sequitur liberum aeris per sanguinem iter. Sed et pauco aere injecto, neque necatis animalibus, pulsus intermittens fit. (Redi vol. iv. p. 223.) Respondit dudum Berge- rus, posse bullas magnas aeris frigore suo coagulare sanguinem, et immeabilitate obstruere vias; neque ideo aeris minimas particulas, sensim et parce admistas eadem mala facturas. Haller. Nat. in Boerh. Praelect. Physiolog. vol. ii. p. 208.*

withdrawn; yet recover upon the timely readmission of it.†

Have not therefore the symptoms of a deep scurvy some similitude to what these animals suffer? For we are told by those who have had opportunities of seeing the worst cases, that the sick are afflicted with vague and excruciating pains, coming on and going off suddenly, which are commonly rendered worse by bleeding;‡ that they have tumours appearing in several parts of the body, different from all others;§ and that they are subject to a sudden and momentary numbness of their limbs, to convulsions, and to palsies of an uncommon kind.|| To all which, let me add the effects of the quick changes of the weight of the atmosphere, which being perhaps more sensibly felt by constitutions of this sort than by any other, seem to confirm what has been conjectured, about the looser connexion of the air with the blood in scorbutic habits.

Lastly, it may be proper to obviate the difficulties of those who maintain, that no animal can live whilst the blood is really putrid, and therefore that the most that can be allowed, is only a tendency to putrefaction. But to this we reply, that besides numberless observations of the corruption of most of the secretions, as

† Boyle Physico-Mechan. Exp. Mem. de l'Acad. R. des Sc. A. 1700, 1707. Musschenbroek Inst. Physic. § 1388.

‡ Eugalen. de Morb. Scorbut. art. xii. et seq. art. xxx.

§ Id. *ibid.* art. xviii. M. Poupert also observes, that in one year a great number of sick being sent into the Hotel-Dieu with some alarming symptoms, he had inquired into the nature of their ailment, and found that it was only the scurvy, but in a more than ordinary degree. Among other appearances, he observes, that several had such large swellings over their body and in their extremities, that they looked as if they had been blown up. Mem. de l'Acad. R. des Sciences, A. 1699.

|| Eugalen. art. xi. xxvi. xxvii.

well as excretions, in diseases, we have frequent instances of the tawny colour of the *serum*, the resolution of the *crassamentum*, and even of the offensive smell of the blood recently drawn.* And indeed if we reflect how putrescent blood is in a heat equal to that of the human body, we may be convinced, that the perspiration by the lungs and skin (or whatever other outlet there may be for the more volatile and corrupted particles) is no sooner impeded, than a resolution begins in the whole mass, which if not timely prevented brings on some putrid disease.†

If the acrimony is great, and the nerves thereby suddenly affected, a putrid fever, a vomiting, or a flux

* Vapor, ex sanguine exhalans, est mitis, blandus, neque nares neque oculos afficiens; in statu tamen præternaturali plane eodem modo, ut sudor morbificus, et vapor ex ulcere manans atque evaporans, acer nares atque oculos ferit. Schwencke *Hæmatolog.* p. 90.

In morbis putridis, dissolutio cruoris quoque advertitur, præsertim pestis specie, in quibus non coagulatur sanguis (scil. e vena emissus) sed gangrænosus et putridus reperitur; quod etiam in eo sanguine observatur, qui post protractam inediam putridus et alcalinus factus est, &c. *Id. ibid.* p. 129.

Sanguis qui per febres putridas detrahitur sæpe animadvertitur non solum fœtidus et graveolens, sed et putridus; adeo ut nec sibi cohærere nec concrecere queat, omnibus scilicet ejus fibris putredine consumptis. Fernel. *de Febr. cap. v.*

Denique notatu dignissimum est, quod mihi nuperrime videre contigit, sanguis fœminæ cujusdam, febre maligna laborantis, per phlebotomiam detractus adeo fœtebat, ut ex ejus tetro odore tam chirurgus quam adstantes in animi plane deliquium incidèrent. Morton. *Pyretolog.*

† It has been the opinion of some physiologists, that the blood is kept from putrefaction by its motion only; but for this they assign no other reason, than their observing the greater purity of running water, and that of the sea when agitated by the wind, in comparison of the same when stagnating. But here, as motion seems only to be the accidental cause, by furnishing means to the water for exhaling its more corrupted particles, so, in like manner, the circulation can only enable the blood to throw off

will ensue. But if the accumulation be so slow, that the nerves grow in some manner habituated to the putrefaction, a scurvy prevails. This is the case not only of sailors, but of others, when milk, greens, and fermented liquors are wanting, and when the greatest part of the diet consists of meats long salted, which, though rendered palatable by the salt, are in effect putrid. Whatever accident, in such circumstances, tends to stop perspiration, is apt to increase the disorder, and especially if the moisture of the air concurs with such unwholesome aliment.*

Now, instances of this kind are so common, that it may seem strange how the corruption of the humours should ever have been contradicted; and indeed for this I can only assign the following reason. By some mistake of the chemists, the notion of the putrefying principle, in animal substances, was confounded with that of an alkaline salt, which salt being looked upon as corrosive, they concluded, that as it could not enter the blood-vessels without destroying both them and the nerves, so the blood could never be supposed alkaline or putrid whilst the person lived. But from several of these experiments we find, that putrid substances are very different from alkaline. I have frequently given of the salt of hartshorn a drachm a day, for a continuance, without observing any septic effects; and since the introduction of Mrs. Stephens's medicine for the stone, we see what large quantities of the fixed alkaline salts may pass into the blood without doing any harm. So different therefore are these salts from putrid matter, that of all stimulating medicines they are perhaps the least hurtful to the such matter as would corrupt it, if retained too long in the vessels.

* See exper. xlv. and Observ. part iii. ch. vii.

nerves and vessels; whilst every corrupted animal substance is not only offensive to the senses, but to the whole nervous system; as is evident from the *nausea*, spasms, palpitations, tremors, dejection of spirits, and other symptoms consequent upon the admission of any strong septic ferment into the blood.

It will appear, that in these papers I have considered the scurvy as arising from a putrid cause only, without regarding whether that putrefaction be owing to corrupted provisions at sea, or to the want of a proper diet in marshy countries. For by not confining the term *scurvy* in this manner, some writers of the first rank have confounded several diseases under that name, though different in their cause, their symptoms, and their cure. I cannot, for instance, see what relation the various kinds of scurfs and tetter (which are *species* of the leprosy) have to the disease of sailors; or how those who admit of putrefaction for one cause of the scurvy, should at the same time acknowledge an acid acrimony for another. It would seem, that they had been led into this last inconsistency by observing, how serviceable the *raphanus rusticanus*, the *cochlearia*, and the like plants were in the cure. For as all these were reputed of an alkaline or putrefying nature, an acid *species* of scurvy seems to have been invented, in order to account for their virtues. But from the experiments laid before the society, it appears, that those vegetables are real antiseptics,* and therefore possessed of qualities very different from what those respectable authors imagined, when they considered their alkaline parts as septic, and their resolution as tending to putrefaction only, and not to fermentation.

* Exper. xi. xx. xxv. xxxviii. 5.

AN

A N S W E R

TO THE LEARNED

PROFESSOR DE HAEN, AND M. GABER;

CONCERNING

Some remarks made by them on the preceding Work.

I. **WHILST** the third edition of my Observations was in the press, I met with a treatise under the title of *Theses Sistentes Februm Divisiones*, published by Dr. De Haen, celebrated professor of medicine in the university of Vienna. Upon perusal, I was a little surprised at observing, that the learned author, in his section *de febre miliari*, after finding fault with Dr. Huxam's sentiments and practice in regard to that, the petechial and nervous fevers, should add, "that
" if, in opposition to his own opinion, any thing were
" advanced from my writings similar to what he had
" condemned in Dr. Huxam's, the same answer, which
" he had given with regard to him, would serve for
" me."* Now, if either Dr. Huxam had copied from

* Sane me cogit veritatis amor, ut acerbe conquerar, virum hunc (Huxam) et Hippocraticum et Sydenhamianum, toties præceptorum utriusque oblivisci. Quæ vero causa hujus? proprii amor systematis, quo id ratum habuit, quod maligni quidquam pluribus in febribus subdelitesceret, calidioribus attenuandum,

me, or I from him, or indeed had there been an exact conformity between us, this short remark might have been sufficient; but as none of these circumstances are true, Dr. De Haen will, I hope, excuse me for showing some of his mistakes on this occasion, so far as I am concerned; for as to what relates to Dr. Huxham, I shall leave that learned physician to say what he thinks proper upon the subject.

For my part, I have been so far from proposing any opinion about the nature of a miliary fever, or the method of treating it, that I have never mentioned the distemper but in the most transient manner. Once, in order to distinguish the pustules peculiar to it, from those of the itch;* a second time, to distinguish those pustules from the *petechiæ* (where I have expressly added, that the miliary fever was not to be confounded with the hospital-fever;†) again, when I observe, that I never saw the hospital-fever accompanied with miliary pustules,‡ and lastly, when I say, that the miliary fever is a rare disease in the hospitals of an army.§

movendumque, sudoribus demum expellendum. Utique plerisque in epidemiis sudori tum symptomatico, tum vi coacto nimium tribuens, fidensque, miliaris ac petechialis eruptionis incautus extitit, nec ullo modo imitandus, admirator....Doleo profecto me hic cogi tanti viri in praxi revelare errores; sed ante me doctrinam, qualem Huxham hic tradidit, condemnavit cel. Gilchrist, in Actis Edimburg. ubi de his ipsis nervosis Huxhami febribus disserens, omnem in iisdem condemnat sudorum provocationem. Si quid forte simile ex egregio Pringle objiceretur, quod ex Huxhamo, simile esto responsum. *Thes. Sistent. &c. sect. de Feb. Mil.*

* Observat. on the Diseases of the Army, 1st edition p. 359. present edition p. 300.

† Ib. 1st ed. p. 302, in the note; present ed. p. 261, in the note.

‡ Ib. 1st ed. p. 358. present ed. p. 298.

§ Ib. 1st ed. p. 359. present ed. p. 300.

Hence it will appear, that I have never considered the jail or hospital-fever and the miliary fever as similar: and indeed I may venture to say, that as the symptoms of the two are so much unlike, they ought to be treated as different *in specie*, and consequently, that neither the theory nor the practice in the one ought to be regulated by analogy from the other. But Dr. de Haen insists on a near relation between the miliary and the petechial fever;* and as he will have that distemper, which I call the *jail* or *hospital-fever*, to be the same with his petechial fever, he thinks proper, in his section on the miliary fever, from principles relative only to that disease, to reflect upon my practice in one of a very different kind.

The jail or hospital-fever cannot properly be called the *febris petechialis*; for I have observed, that though the eruptions, which I call *petechiæ*, will often appear in the fever which I saw, yet they do not constantly accompany it, and therefore have not a title to characterize that disorder, any more than the plague, of which likewise they are a frequent symptom. This distinction, between a petechial fever, and a fever sometimes attended with *petechiæ*, not apprehended by Dr. de Haen, is well laid down by Sennertus, in his account of the *morbis Hungaricus*, which, as I have elsewhere remarked, was a camp-fever raised to a high degree of malignity. Sennertus says, *Nonnulli morbum Hungaricum et febrem petechialem plane pro eodem morbo habent; sed mihi quidem videtur, non*

*At the conclusion of his section, *de Febre Petechiali*, he says, *Multa de Petechiis dicenda supersunt; maxime de iisdem tum præveniendis, antequam fiant; tum, cum adsint, curandis: verum cum hæc quoque ad Miliarium eruptionem pertineant, ipsaque Miliarium historia eam Petechiarum elucidet, atque explanet, una fidelia hunc utrumque parietem dealbabo.*

satis recte. Etsi enim petechiæ et maculæ illæ quandoque etiam in morbo Hungarico conspiciantur, tamen non semper id accidit, et potest hic morbus esse sine maculis. Contra vero maculæ in febre petechiali omni inveniuntur; unde et nomen hæc febris habet.* I have therefore all along considered the jail or hospital fever (in regard to others that commonly occur in these parts) as a fever *sui generis*, at least as different from either the scarlet, the miliary, or any other eruptive fevers which are known here. Indeed, unless at the times mentioned in my treatise, I hardly ever met with such a disease; and I believe that some learned and experienced physicians of this place, employed for those who were taken ill of the jail-fever (at the Sessions held at the Old-Bailey, in the year 1750) had, from the mortality attending it, too good reason to believe, that this disorder was not to be treated in the same manner, either with the miliary fever, or any other which they had been conversant with before.†

The chief cause of Dr. de Haen's mistake, and of the confusion of other authors in treating of these fevers, may be the undetermined meaning of the word *petechiæ*; and indeed the ambiguity here is such, that I must regret my having at all used the term, and not being satisfied with barely describing the eruption, without giving it any name. The terms *lenticulæ* and *puncticulæ*, given by Fracastorius, afford no just idea of the spots which I constantly saw: or if, with Dr. de Haen and others, we use the expression *morbus pulicaris*, the only resemblance of those spots to the bites of fleas, will lie in the colour; though these last are commonly redder. *Febris purpurata* is not more pro-

* De Febr. lib. iv. cap. xiv.

† See the account of it in the preceding Observations, part iii. ch. vii. § 6.

per; because the purple colour I have never seen, except when there were large blotches *plagæ* or streaks of a considerable length upon the skin. Diemerbroeck, upon the plague, says that the mortification in the *petechiæ* reaches from the skin to the *periosteum*; where it is plain, that he can only understand such purple spots as are seen in the bad small-pox, scattered here and there; and not such an efflorescence as appears in the jail or hospital-fever, often covering the whole trunk, arms and legs, so thick, that, at a little distance, the interstices are hardly to be discerned. Dr. de Haen says, that in the German language the *petechiæ* are called *pfefferkorn* (pepper-corn) on account of their round figure; and in another place, he defines them *punctula rubra, aut cinerea, aut purpurea, aut livida, aut nigra*. But I have never seen in the jail or hospital-fever those small spots of any regular figure, nor of the *color cinereus*; at least, if he means the colour of wood-ashes. Nor did I ever see them black, nor purple; though the large streaks of *vibices* have much of that cast. Possibly the hot stoves, and unventilated apartments, so common in Germany, with too hot a *regimen*, which Dr. de Haen justly condemns, may frequently bring out, in common fevers, those spots, which resemble flea-bites, and which he calls *petechiæ*; whilst never having had occasion to attend the sick in jails, nor in the foul and crowded hospitals of an army, he has had no opportunity of seeing that eruption, which I call *petechial*, nor the malignant or pestilential fever which it so often accompanies. Nor have I found, in any author, this eruption so defined, that I could reckon it quite the same with that which I describe. Dr. Huxham, who during the former war had opportunities of seeing this distemper at Plymouth (whilst the jails were filled with French prisoners, and

the hospitals with our own sailors) observes, in his chapter on putrid, malignant, and petechial fevers, “that the skin looked sometimes as if it had been marbled or variegated with a colour like that of the measles, but more dull and lurid.” This is indeed nearly the thing which I saw. But as that learned author likewise mentions the *petechiæ*, as a symptom of the same fever, I can only conjecture that he meant the same eruption, but called it *petechial* when the spots were single, and more distinctly seen.

I consider those spots, which I have called *petechiæ*, to be the effusions of the *serum*, tinged with some red globules (which being resolved by putrefaction, are enabled to enter into the serous vessels) and that these effusions are made in the *cryptæ* or cells of the *cutis vera*; which cells are smaller, but similar to those of the cellular membrane, of which, according to the best anatomists, the skin is formed.* And perhaps it is owing to the closer texture of the skin of the face, that such effusions so seldom make their appearance there. As to the *vibices* or streaks of a more purple cast, I imagine they may be owing to similar extravasations, where the fine vessels of the *cutis vera*, made tender by putrefaction, have given way, when the patient, by accident, has scratched himself: for I have sometimes observed the streaks so long, and so parallel to one another, that I could not help thinking they were produced in this manner by the fingers.†

* Haller. Prim. Lin. Physiol. § ccccxxiv.

† Dr. De Haen says, *Nec sola macularum sedes cuticula est, &c.* Thes. Sist. p. 33. where he does not mention the true skin at all, as the seat of the *petechiæ*, but the *cuticula*; which I wonder at, seeing the scarf-skin having neither cells nor vessels, so far as we know, is not susceptible of an inflammatory colour: nor can the effusions be made between the *cutis vera* and the *cuticula*, with-

Dr. de Haen allows, on the authority of Sydenham and others, “ that the *petechiæ* may be considered as “ critical in the pestilential fever;” but adds, “ that “ even in the plague itself, this eruption would seldom “ take place, were the antiphlogistic method of Bo- “ tallus and Sydenham strictly followed.”* If so, what must he then think of the *petechiæ* in times not pestilential, such as ours? The author plainly tells us what he thinks, by applying to the present German physicians that censure which Sydenham passes upon his own cotemporaries, *viz.* their converting, by means of “ the *regimen calidissimum*, common fevers into the “ petechial and miliary.”† As to the latter, in particular, though he concludes, and justly (with Sydenham) *Miliaria exanthemata frequentius mala arte progigni, sponte longe rarius,*‡ yet, in another place, he pretty plainly insinuates, as if the miliary eruption would never be seen at all under proper management; if so we may judge by the following passage: *Liceatne id addere, quod et medici complures et ego in nosocomio, sive in vigore morborum, sive eorundem in fine, nunquam nostris in ægris, quibus a principio affu-*

out pustules, or some elevations of the latter, which I never saw with that eruption. Further, I observe, that Dr. de Haen joins with those authors, who contend for the seat of the *petechiæ* being likewise in the fat, and in the flesh, and does not express his dissent from Diemerbroeck, who imagined, that he could trace them from the *periosteum*, where from a broad base they tapered all the way to the skin. Now, if Diemerbroeck found these pyramidal substances mortified, what must be the mortification at the root of our *petechiæ*, when their points almost cover the skin? And even then the patient may not only recover, but is liable, to no separation of parts, as in a true gangrene. It is therefore plain, that either Diemerbroeck must have been mistaken, or that his *petechiæ* were different from those described by me.

* Thes. Sist. p. 35.

† Ib. p. 35, 36.

‡ Ib. p. 68.

eramus arbitri, miliaria deteximus.* Although, as I have said, the miliary fever is no part of my subject, yet here, by the way, I must observe, that to whatever excess the hot regimen was carried, in this country, in Sydenham's time (and I believe the excess was great) or whatever may still be the sentiments of some amongst us, the best, and I should hope, the general practice is at present different. In the beginning of most fevers we bleed, keep the body open, recommend free air, give acids, diluting liquors, and diaphoretics of a cooling kind; yet in certain seasons, miliary eruptions will appear, and although not always, yet sometimes will relieve the patient, and give a favourable turn to the disease.

But as to the jail or hospital-fever, I can more freely affirm, that the spots accompanying it were not the effects of a hot *regimen*; but on the contrary, that those *exanthemata* were never more apt to appear, than when the patient was largely bled in the beginning, and in the advanced state took nothing cordial. This indeed was not to be wondered at, if these spots, being the effects of putrefaction, were most readily produced when the vital powers were at the lowest. Thus, sometimes they were not seen till the last agonies, or even till after death; whereas the small-pox, measles, scarlet efflorescence, *erysipelas*, and miliary pustules, being more of an inflammatory nature, and attended with some kind of tumour, are most conspicuous when the circulation is strong; and, on the other hand, subside, or disappear when the patient is near his end. Is not this a proof of a specific difference between the jail or hospital-fever and the miliary fever?

Nor does Dr. de Haen sufficiently attend to what

* Thes. Sist. p. 66, 67.

Sydenham says on the subject of the *petechiæ*. For though Sydenham ascribes them, for the most part, to too hot a regimen, yet he acknowledges that they come out spontaneously in the plague and in the confluent small-pox;* and I have endeavoured to show, that the jail or hospital-fever belongs to the pestilential class of diseases. Sydenham indeed believes, that those *petechiæ*, which he mentions, depend upon a high degree of inflammation, but he does not prove it; and I should think it more probable, that they are, as I have observed, the effects of blood resolved by putrefaction; a principle which Sydenham does not seem to be acquainted with. As to their being rarely critical, I shall venture to go beyond both Sydenham and Dr. de Haen, and say, that even in the plague itself, I much doubt whether they are more critical than in the fever of jails or hospitals, where indeed they never are so, as I have expressly said in my Observations on the Diseases of the Army.†

* Raro sponte sua efflorescunt, præterquam sub adventu pestis ipsius, atque in initio variolarum istarum confluentium, quæ summæ inflammationis participes sunt. *Sydenh. Schedul. Monitor.*

† After publishing what is above, relating to the distinction, which I conceived was to be made between Dr. de Haen's *petechiæ* and mine, I was confirmed in my opinion by Dr. Huck, who, in the year 1763, was at Vienna, and was favoured with admittance into all the hospitals there, and in particular had the satisfaction of attending Dr. de Haen himself, and seeing with that celebrated physician, some of his patients in that very fever which he calls *petechial*. Dr. Huck examined those spots in Dr. de Haen's presence, and assured me, that they had hardly any resemblance to those which I have called *petechial*, and which he himself had so often seen in the hospitals of the army; but, that they were so like flea-bites, that he was apt to believe the one must be often mistaken for the other. Dr. Huck added, that he had seen several cases of those fevers in the other hospitals, at

Lastly, as to the hot regimen in the miliary and petechial fever (for which Dr. de Haen blames Dr. Huxham, and me through him) it must be clear how little I am concerned, since I mention nothing of my practice in the miliary fever; and since it appears, that Dr. de Haen's petechial fever is different from that of our hospital. But granting them to be the same, the learned author may observe, that the regimen which I prescribe is far from being hot throughout. Sweating, I indeed advise upon the first symptoms, as Sydenham did in the plague, to prevent the fever; but I promote that sweat by mild sudorifics. Half a drachm of *theriacæ*, with ten grains of salt of hartshorn, once in four and twenty hours, washed down with some warm vinegar-whey, to a soldier lying in bed without curtains, and often in a cold ward, is surely no very heating medicine. And as I am convinced, that in my own case I have more than once prevented this fever, by sweating (when I had reason to believe I had taken the infection) I must recommend that practice to others,

Vienna, but none of those spots of a deep purple colour, like such as appear in a bad kind of the small-pox; and that therefore he believed, they ought to be considered as no less specifically different from the *maculæ purpureæ variolarum*, than from those which accompany the jail or hospital-fever. He concluded with observing, that those petechial spots of the hospitals of Vienna, for the most part, attended a slighter kind of fever: from which he accounted for that extraordinary success, in curing so many of these petechial fevers, which Dr. de Haen relates in page 86th of his *Theses*. And indeed how should it otherwise happen, that of about 500 soldiers admitted into an hospital, with petechial fevers, twelve only, and those too whose cases were too far advanced, should die? Since this account, I have seen, with Dr. Huck, in this city, three several cases of such *petechiæ* as are described by Dr. de Haen, and found not only those spots, but the symptoms of the disease, a good deal different from those of the jail or hospital-fever.

which I found so beneficial to myself; though I must own, that, as I am easily thrown into a sweat, my sudorific was no hotter than spirit of hartshorn, with vinegar-whey, or the *spiritus Mindereri* in a large draught of some diluting liquor. When the fever was formed, the patient took the same medicines as in inflammatory cases; and I never prescribed the hot course, if so it must be called, till his pulse sunk and his strength failed; still attentive so to moderate this new regimen (which consisted chiefly of wine) as never to increase the feverish heat, much less to force a sweat, or to hasten any other crisis, before the natural period of the disease. I have expressly said in all the former editions, as well as in the present, that “I have observed
 “that a *delirium* would arise from two opposite errors;
 “one, from large and repeated bleedings; and the other,
 “from wine and the warm cordial medicines given
 “too early; it appears therefore how nice the principles are that regard the cure; thus, neither a hot,
 “nor a cool regimen will answer with every patient,
 “nor with every state of the disease.”*

Dr. de Haen might likewise have taken notice, how anxiously I recommend a free circulation of air; which perhaps none of his students would believe after he makes the following exclamation: *Quam sapiebant præ nobis Antiqui! Videte apud Cælium Aurelianum Methodicos, calidis in morbis, in id præcipue intentos, ut cubiculum et amplum, et aëre bene perflatum, et subfrigidum esset, &c.* I wish, I say, by taking notice of the following passage, he had done me justice with his pupils, who, after his insinuations against my practice in this distemper, will scarce expect to find, in the chapter on the jail or hospital-fever (in all the edi-

* *Observ. part iii. ch. vii. § 5. page 279.*

tions) this plain admonition, yet almost as strong as any of those of the ancients upon such a subject. “ In the first state (*viz.* of the hospital-fever) as well as in all the rest, the fundamental part of the cure is to remove the patients out of the foul air. When that cannot be done, the room or ward is to be purified, by making a succession of air, by means of fires, or letting it in by doors and windows, diffusing the steams of vinegar, or the like; for whatever medicines are given while the corruption of the air continues, or indeed increases by the *effluvia* of the sick, there can be little hopes of recovery. Therefore, in every stage, though the patient can breathe no infectious air but that of his own atmosphere, it will be necessary to keep the curtains open, and to use all other means to procure a free ventilation. On the strict observation of this rule, the cure will in a great measure depend.”* As to the caution of not loading the sick with blankets, I confess I have omitted giving any of that sort; because, in this country, physicians do not suppose that a patient, in any fever, is to lie warmer than in his best health. To this cool regimen, it may be observed, that I add the use of acids, and recommend the lowest diet; so that hitherto there is no reason to apprehend any inflammatory symptom. The small proportion of the contrayerva-root, in the compound powder of the London Dispensatory, in the dose which I specify,† could occasion no sensible heat; and even then it was joined to nitre. The camphire, in so small a dose, could only heat by accident,

* *Observ.* part iii. ch. vii. § 5. p. 269.

† In a scruple of this medicine (which was my common dose, repeated once in six hours) there are only about five grains of the contrayerva-root, and the rest of the composition is only a testaceous powder.

that is, when it disagreed with the stomach, and then it was laid aside.

It was therefore only in the advanced and low state of this fever, that I began to support the strength by medicines of a cordial nature, and yet with such effects, as rather to abate than to augment the ardour. By these, and especially by wine, I will venture to affirm, that I have frequently seen every symptom soon change for the better, that is, the head become clearer, the skin cooler, and the thirst less; and indeed this is not to be wondered at, when we consider how probable it is, that the putrefaction, gaining ground by the sinking of the *vis vitæ*, occasions that acrimonious heat, so remarkable in this disease. Here, the salt of harts-horn was only used occasionally in great depressions; and even in other cases, I have never been sensible of its raising any inflammatory or fixed heat, but only a momentary glow. The common medicine was the alexipharmac decoction, consisting of the bark and snake-root, with a small proportion of the *aqua alexeteriu spiritiuosa cum aceto*. It is to be hoped, that though the alexipharmacs have been long abused, as to the choice, the quantity, and application of them, yet no offence will be taken at the name. Four spoonfuls of that decoction, once in four or six hours, to a soldier with a sunk pulse, lying in a bed without curtains, and with few clothes, seldom occasioned any extraordinary heat; if it did, I either lessened the dose, or, believing the time not yet proper for administering any warm or strengthening medicine, I suspended its use for a day or two longer. The disgrace of the alexipharmacs has been chiefly owing to the opiates joined to them, as in the *theriaca*, *diascordium*, &c. but in the hospital-fever these last were never used, unless in order to check a colliquative looseness; or about the crisis, when the

patient was worn out by want of rest: at such times I have known the opiates of the greatest service.*

In fine, Dr. De Haen may be assured, that the regimen, which I propose, stood at first on no other foundation than experience, after my having seen the bad effects of a contrary method, whether by too large, or too frequent bleedings in the beginning, or by giving hot things too early, in order to raise the pulse when it began to sink, or to force a crisis before the common period of the disease. Some of the medicines may be superfluous, but I am pretty sure that none of them are hurtful. The first perhaps might have been omitted, I mean the diaphoretic powders (consisting of the *pulvis contrayervæ compositus*, camphire, and nitre) since I never knew the fever shortened, or any symptom abated by their use. But having once got into a method, which brought about as many cures, as seemed otherwise consistent with the circumstances of my patients lying in a foul air, amidst a constant

* From what Dr. de Haen says, of the use which he himself made of cordials, in the low state of miliary, petechial, and nervous fevers, in order to bring on a crisis, we should hardly imagine, that he could blame that part of my practice, in that malignant fever, which I treated, where the *vis vitalis* was so apt to fail. The learned author, after condemning in Dr. Huxham the too free use of the *confectio Raleighiana*, *theriaca Andromachi*, *radix serpentaria Virginiana*, *radix contrayervæ*, *sal cornu cervi*, *vinum rubrum cum mace & cinnamomo ustulatum*, &c. in the nervous fevers, subjoins these words: *Lubens equidem fateor, cardiaca ejusmodi nonnunquam danda esse, ut labascens in morbis natura ad bonam crisin animetur; at vero omnium morborum curam, in quibus maligni quid apparare supponitur, hisce excitantibus perpetuo aggredi velle Hippocraticum non est, Sydenhamianum non est.* These principles I have likewise adopted, and have endeavoured to regulate my practice accordingly; not because they were Hippocratic, or Sydenhamian, but as they were the result of repeated experience.

noise, and often neglected by their nurses, I did not attempt to reduce my practice to more simplicity than what is mentioned. Yet whatever confidence I may have in the directions which I have published, I am still ready to alter any part of them, upon a fair representation from those who have had equal opportunities with myself of seeing and treating this fever. But to oppose either mere theory, or analogy from other fevers, where the similarity is so disputable, or to oppose some general maxims from Hippocrates or Sydenham to the observations which I have offered, as the result of a long and painful experience, in a distemper that no physician could well know but in such circumstances as mine, is a manner of writing, I must say, more fitted for disputations in a school of medicine, than for the instruction of a practical physician.

II. I must unwillingly take notice of some more inadvertencies of the learned Dr. De Haen, with regard to me; for treating of camphire he says, *Quantisne laudibus effertur in malignis camphora, veluti collapsas vires blande restaurans, et somnum ipso opiotutius adducens! Consulite modo egregios viros Huxham & Pringle.** The author then proceeds to observe, that the physicians of Breslaw found no such virtues in that medicine, in a malignant epidemic of that country; but on the contrary, remarked that it rather did harm. Now though the learned author intended no reflection upon me, yet the reader must be surprised, when I affirm, that I have no where assigned either a *paregoric*, or a *restorative* quality to camphire, nor used any expressions to that purpose. I mention my giving it in inflammatory fevers, but with no other intention than to assist in abating the spasms,

* De Haen Ratio Medendi part iii. cap. i.

and in promoting a *diaphoresis*; and when I prescribe it in the high *delirium* sometimes attending the hospital-fever, yet even there I say nothing of those alleged qualities, but only offer it as one of the best internal medicines for that symptom, that is, one of the best I then knew; which, in truth, was saying but little in its commendation. In my experiments, I have indeed assigned to camphire a considerable antiseptic power; but that has nothing to do with the virtues in question, nor have I, for that reason, ever given it the more freely. It would seem, as if Dr. De Haen finding such a conformity between Dr. Huxham and me, with regard to the jail or hospital-fever, believed the harmony to be so great, that, whatever is written by Dr. Huxham, I must be of the same opinion, and answerable to the Breslaw physicians for it.

III. Lastly, Dr. De Haen, in the first part of his book called *Ratio Medendi*, mentions some experiments, which, in imitation of mine, he had made with antiseptics upon urine; when he found, that acids resisted its putrefaction more than any of the alkaline salts, the spirit of hartshorn excepted. In this the learned author does not contradict me, as some of my friends have imagined, since not doubting of the antiseptic quality of the acid salts being in general superior to that of the alkaline, I never made any comparative trial. Nay, I have here the satisfaction, to find a person of Dr. De Haen's credit, confirming in this instance, what I had long ago advanced, *viz.* that the volatile alkalies are powerful in preserving animal substances from corruption. I only wish, that Dr. de Haen had mentioned his experiments with more precision, and, in particular, had told the proportions which he used of the acids and alkalies; since it must seem a greater paradox than any that I have yet ad-

vanced on that subject, that, quantity for quantity, the spirit of hartshorn should resist putrefaction more than any of the mineral acids. But when, in the next paragraph, the author adds *constititque urinam alcalicis (viz. salibus alcalicis fixis) mistam longe citius putrescere ea, cui affusum nihil*, that is, “that a portion of
“urine mixed with the fixed alkaline salts putrefied
“sooner than another portion, to which nothing was
“added;” there indeed is a plain contradiction to the conclusions that I have drawn from my experiments, which allow of no septic quality in any of those salts, fixed or volatile.

To see therefore which of us was in the wrong, about the end of June 1760, I made the following experiment. I took three phials, of between three and four ounces each, and into each poured an ounce of recent urine made by a person in health; to one, I added five grains of salt of hartshorn (as being of a more constant strength than the spirit, which so much varies according to the manner of preparation, and the time it is kept;) to another, I added as much of that salt which is sold in the shops for *sal absinthii* (but which, in fact, is a thoroughly calcined lixivial salt, drawn from the ashes of any of the common vegetables;) to the third, I joined nothing, reserving it for a standard. These phials, being corked, were placed in a closet of a southern aspect; so that considering the season they stood moderately warm. Upon the first mixture, the phial with the salt of hartshorn had scarce any other smell but that of the volatile salt. The phial with the salt of wormwood, upon shaking, became turbid, and of a whitish colour, without any effervescence; but with that disagreeable smell, which I have always found upon mixing animal substances with the lixivial. Next day, the standard was not so fresh as at

first; the phial with the salt of hartshorn smelled as before; and that with the fixed alkaline began to smell of a volatile salt, but less disagreeable than that of stale urine. In two or three days longer, I could scarcely distinguish between the smell of the urine which contained the salt of hartshorn, and that with the salt of wormwood; and this resemblance continued for twenty-four days, after which I examined those phials no longer. With regard to the standard, it remained all that time with a sickish offensive smell, neither like that of salt of hartshorn, nor that of corrupted flesh or blood; and for some days before I ceased to examine it, I observed a mouldiness upon its surface.

In the beginning of September following, to an ounce of recent urine, poured into a wide-mouthed phial, I added six or seven grains of fixed alkaline salt as before; and into another phial, I put as much urine, without any addition, to serve for a standard. These phials were set in a place somewhat damp, open to the air, but under cover, to prevent any rain from falling into them; for they were not corked. The mixture with the fixed salt, upon shaking the phial, became turbid as before, and afterwards dropped a whitish sediment; which ought to have been taken notice of in the first experiment. The smell of this phial, upon the mixture, was disagreeable as before; the next day, it was less so; and on the third day, the smell began to change to that of salt of hartshorn, which gradually increased, with some degree of rankness, like that of common stale urine. The standard, for about eight days, had no smell of volatile salt, but was otherwise offensive; and upon its surface, I perceived a mouldy scum thicker than that in the former experiment. I took no further notice of these phials till about the thirteenth day, and then I found them both smelling

like salt of hartshorn; but the standard, that is, the urine by itself, ranker or more offensive than the other. At the same time, I found the contents of the standard of a deeper colour, which I considered as another proof of its higher degree of corruption. For I have constantly observed, that urine becomes of a browner cast in proportion to the time it is kept, till it be thoroughly putrid; and in this case the *criterion* is the surer, as the fixed alkaline salt, when the urine settles after the mixture, makes it darker than natural; that is, on the second day of this experiment, the water with the fixed alkali was not so pale as the standard, but was paler than it on the thirteenth.

After this, I made no further trials, being satisfied that I had not been in the wrong, about the general antiseptic power of the fixed alkaline salts, and that I had discovered the cause of Dr. de Haen's error. It is well known, that urine not only contains some of the corrupted parts of the humours (which nature throws off by the kidneys, as well as by the skin) but likewise a large quantity of a salt of the Ammoniacal kind, that is, one compounded of a volatile alkali and an acid. Now, this acid having a greater affinity with the fixed alkaline salt used in these experiments, than with its own volatile salt, abandons it, and, cleaving to the fixed salt, suffers the other to evaporate; much in the same manner as we produce a volatile urinous smell, upon adding salt of wormwood, or salt of tartar, to a solution of *sal Ammoniacus*. Only, in the case of urine, the combination of any fixed alkali with the acid of the urine, and the evaporation of the volatile salt of the urine, consequent thereupon, is slow, on account of an oily or mucous matter, with which that fluid is likewise impregnated. It does not therefore follow, because putrefying urine always lets go its volatile salt,

that all urine parting with this salt, is in a putrid state. For the same kind of salt, with its volatile smell, rises from the most recent urine upon distillation; and, without that process, instantaneously, upon mixing some quick-lime with it. Nay, a fixed alkaline salt will immediately disengage the volatile, and thereby give the stale smell, if the fixed salt be dissolved in fresh urine made boiling hot. Even within the body, an animal process will separate this volatile alkaline salt, as I had once an occasion to find in a person, who had been long under a course of Mrs. Stephen's medicine, that is, of taking large doses of lime and a fixed alkaline salt. This gentleman's urine, when quite recent, had not only that volatile smell which I mentioned, but strongly effervesced with the common acids. This experiment he showed me, immediately after making water, upon my seeming to doubt whether he had not been mistaken.

I therefore suspect that Dr. De Haen, not reflecting on this chemical principle, has been deceived by the volatile saline smell of the urine (occasioned by the mixture of a fixed alkali) which he mistook for the putrid *fætor* of that fluid; and that though convinced, by his own experiments, of the strong antiseptic quality of salt of hartshorn, yet he could not thoroughly free himself from the common error, of confounding the volatile saline with a putrid smell. But this distinction, between an alkaline salt and putrid matter (in an animal substance falling into a state of resolution) which I attempted to explain in the preceding work, is at present set in the clearest light by the learned M. Gaber of Turin; of whose experiments, and just reflections upon them, I shall now take notice.

IV. Some time ago, I received from that gentleman the present of a book, lately published called, Miscel-

lanea Philosophico-Mathematica Societatis Privatæ Taurinensis, accompanied with an obliging letter; of which I hope, he will excuse me for giving the following extract. Ex tuis experimentis mea nata sunt, quorum aliqua in hoc libro perlegere possis; reliqua, quæ nondum ita absoluta sunt ut publicam lucem mereri videantur, in posterum, si libenter feras, tibi communicabo. Hæc autem experimenta, cum plerumque tuis consentanea fuerint, in ea tamen re a te me dissentire cogunt, quod *alkali* existentiam in corruptis humoribus dubiam reddidisti; rationes propterea proposui quibus eventuum dissimilitudinem adscribendam putavi, quas tu ipse facilius, quam ego assequi poteris, si tuam experiendi methodum cum mea comparare volueris.

The point in question relates to my first experiment, which shows, “that bodies, by putrefaction, become little, if at all, alkaline.” But the ingenious author, in the paper which he alludes to in his letter, clearly proves, “that the marks of alkalescence, in putrefying animal substances, are greater or less, or none at all, according to the time in which the experiment is made, after the putrefaction begins; that such substances, upon their first putrefaction, do not effervesce with acids; that afterwards they effervesce manifestly with them; but, that at length they cease from doing it, though the putrefaction still continues.” The experiments proving these facts being repeated with so much clearness and precision, leave me no room to doubt of the truth of what M. Gaber suspects, *viz.* “my having made the trials of effervescence upon putrid bodies, either before they were sufficiently corrupted, or after the volatile alkaline salt was wholly evaporated, though the process of putrefaction still went on.”

At this distance of time, I cannot sufficiently recollect the circumstances of my experiments, whereby to judge, whether the acid was dropped into the putrid liquors before, or after the exhalation of the volatile salt; but as I am satisfied, that it might have been the one or the other, I must submit to M. Gaber's correction, and allow, that whilst animal substances are in a state of putrefaction, there is a time when they will afford marks of an alkaline salt, by their manifest effervescence with acids. And I am the more inclined to yield to his opinion, as I can now produce a case somewhat parallel to what he mentions, relating to the effervescence of morbid bile with acids.

A gentleman of thirty-six years of age, who died of a dropsy following an obstinate jaundice, was opened about twenty-four hours after his death. The liver, by its tenderness, seemed to be in a corrupted state. The gall-bladder was full of bile, and three times larger than is common. The *ductus communis* was so closely stopped at its entry into the *duodenum*, that no bile could be squeezed out of the bladder into that gut. As the dissection was made by candle-light, I could not then examine the bile; but the next morning, Mr. Forbes, the surgeon who had opened the body, returned to the house, and at my request made the following experiment upon that liquor, which had been kept all night in a tea-cup, in a room without a fire, in the winter-season. He divided the bile into three portions; to one, he added some fixed alkaline salt, but that occasioned no change in the colour, which was of a dark green; into another, he dropped some spirit of vitriol; into the third, some common vinegar; and he observed in both those a manifest effervescence, with a change of the colour to a light green. The experiment was pursued no further; but I doubt not, that had the bile

been allowed to corrupt longer, the effervescence would have appeared less and less, and at last have entirely ceased, by the separation of the alkaline from the corrupted parts, agreeably to the observations of M. Gaber. But from all this, it appears more and more evident, “that the volatile salt, in animal substances, “is very different from the putrid part; that an animal “substance may abound with this volatile alkali, and “yet not be the more corruptible; and, on the other “hand, be highly putrid, without any mark of alkalescence; lastly, that the volatile alkaline salts are all “of an antiseptic nature.” These principles, which I endeavoured to establish, have been more fully demonstrated by M. Gaber; and I must set the greater value upon his labour, as it has satisfied the illustrious M. de Haller; who, in the second volume of his Physiology, makes several objections to my opinion, about the distinction to be made between putrid and alkaline substances, but afterwards, whilst his book was still in the press, having seen M. Gaber’s paper upon that subject, in the last page he candidly acknowledges, that the experiments of that gentleman had fully reconciled him to my sentiments on those matters.

THE END.

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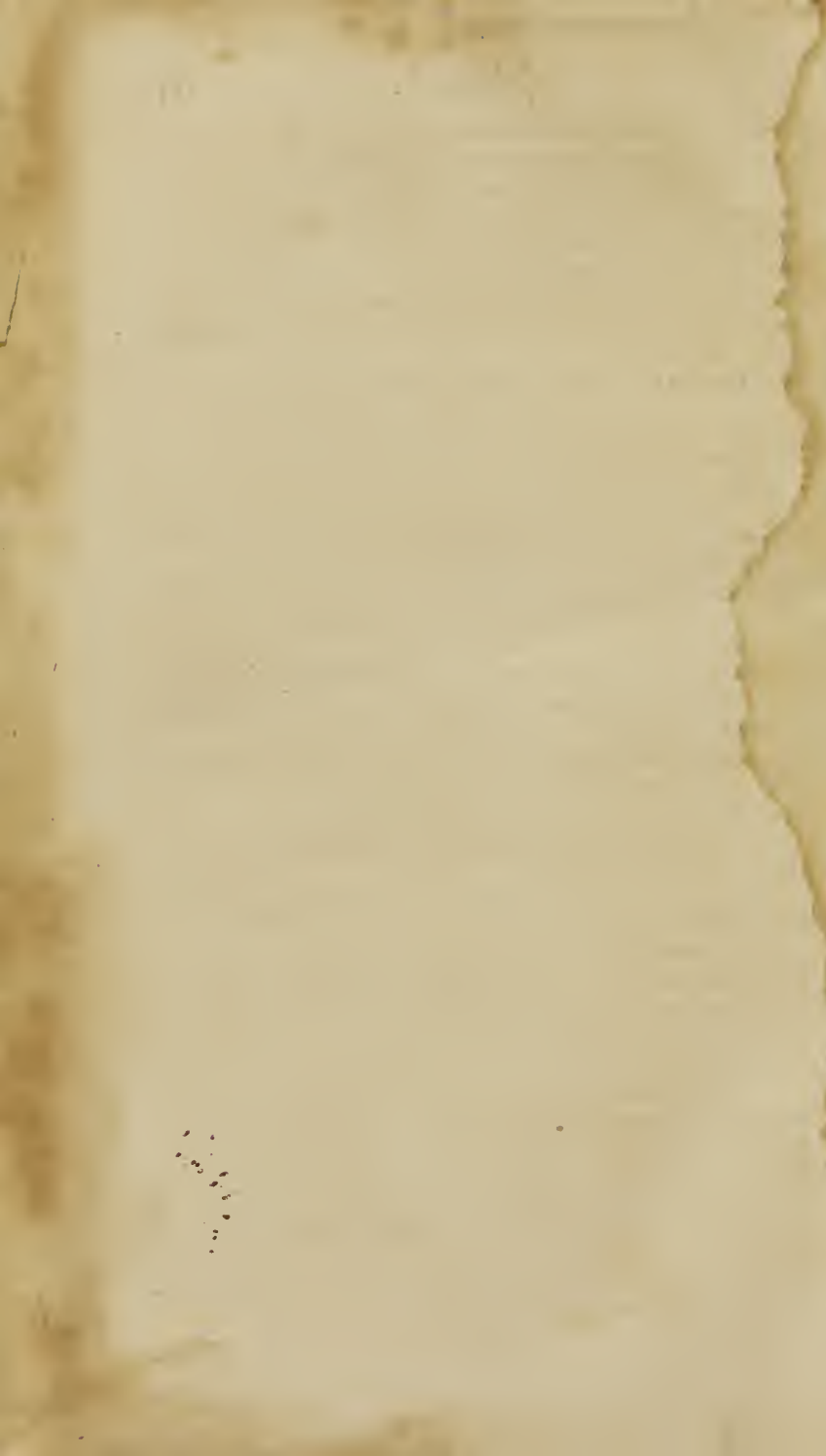
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