

Observations on the diseases of the army in camp and garrison : in three parts, with an appendix containing some papers of experiments read at several meetings of the Royal Society / by John Pringle.

Contributors

Pringle, John, Sir, 1707-1782.

Publication/Creation

London : Printed for A. Millar, D. Wilson, and T. Durham ... and T. Payne ..., 1753.

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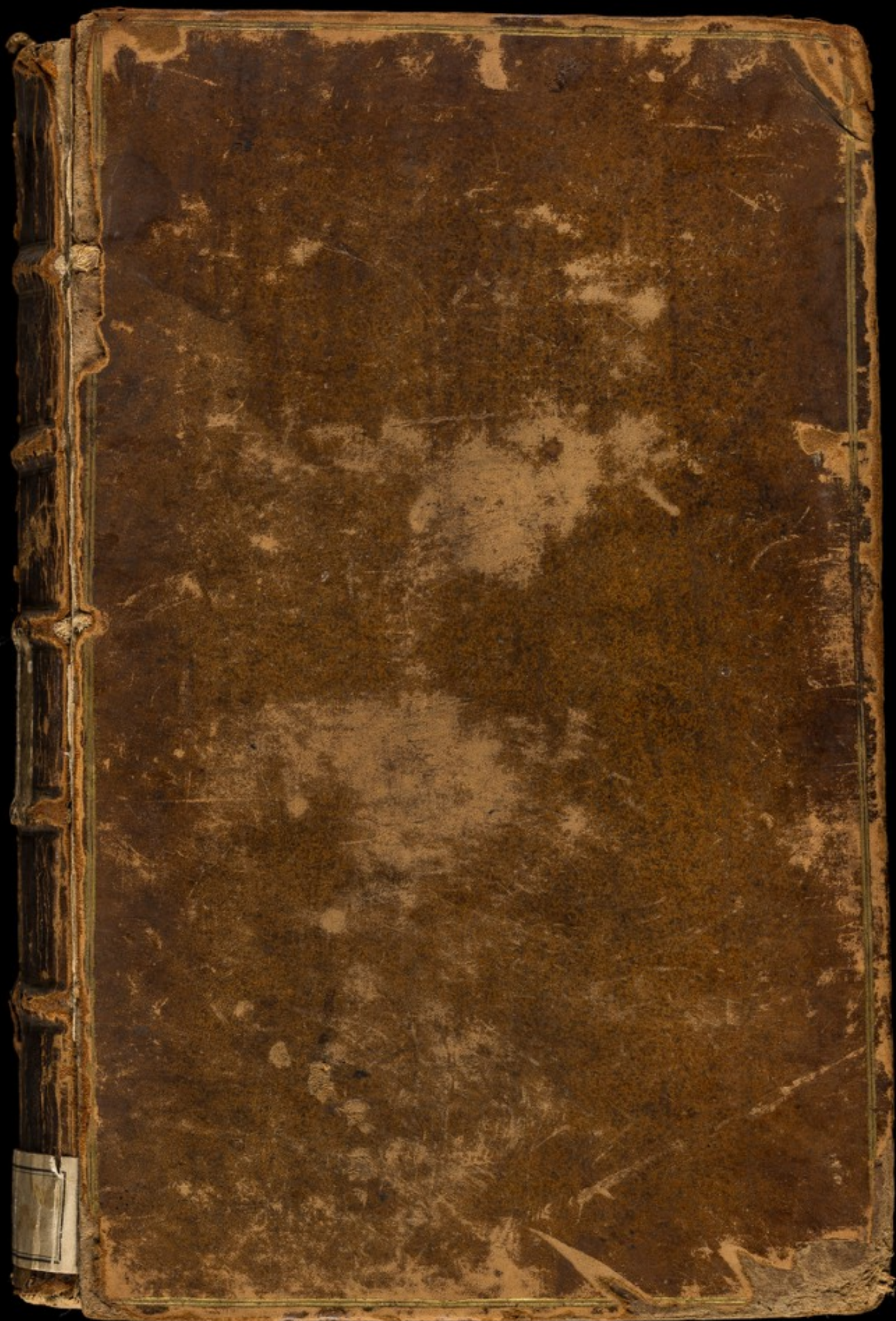
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N. Bruce

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Army Medical Department
by Winian Price Esq. Deputy
Insp. Genl. of Hospitals. —

1032,

8.



[Faint, illegible handwriting in cursive script, possibly a list or account.]

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Pringle. Sir. John.

Observations on the Diseases of
the Army in Camp and Garrison,
2ed. London. 1753.

Note:- The first edition of this
work was printed in the year 1752.
He was a pioneer of the antiseptic
idea, and Stephen Hales was instru-
mental in securing better ventil-
ation for those confined in ships
and jails, barracks and mines.
Was founder of modern Military
Medicine and was the originator of
the Red Cross idea.

SOCIETY.

BY

JOHN PRINGLE, M.D. F.R.S.

Physician-General to his MAJESTY'S Forces employed
abroad during the late War.

The SECOND EDITION corrected, with Additions.

L O N D O N:

Printed for A. MILLAR; D. WILSON and T. DURHAM,
in the Strand; and T. PAYNE, next the Mews-gate, near
St. Martin's Church. MDCCLIII.



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OBSERVATIONS

ON THE

Diseases of the Army,

IN

CAMP and GARRISON.

IN THREE PARTS.

WITH AN

A P P E N D I X,

CONTAINING SOME

PAPERS of EXPERIMENTS,

Read at several Meetings of the ROYAL
SOCIETY.

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QUESTIONS

OF THE

Diocese of the Army

IN

CAMP and GARRISON

IN THE

WITH AN

A P P E N D I X

CONTAINING

TABLES OF EXPERIMENTS

AND A FEW NOTES OF THE

SOCIETY

BY

JOHN PRINGLE, M.D.

IN A DISCOURSE DELIVERED AT THE

ANNUAL MEETING OF THE

ARMY AND NAVAL SOCIETY

L O N D O N

PRINTED BY A. MILLAR, IN ST. MARTIN'S LANE

AND BY J. BARNES, NEW-STREET

IN THE STRAND



P R E F A C E.

THE diseases of the army have, as far as it appears, been treated of by none of the antient physicians; nor have we any information about them from the historians, unless when some very uncommon or fatal distemper attended an expedition.

*Thus Xenophon, in his relation of the famous retreat of the Greeks, mentions their being liable to the fumes canina, to a blindness, and to a mortification of the extremities, from the snow and excessive cold they were exposed to on their march. Pliny, the naturalist, first takes notice of the scurvy, which afflicted the Roman army, in Germany, after continuing two years in that country *; and we likewise find that the Romans were sometimes under a necessity of removing their camps, on account of the*

* Ancient Germany included the northern parts of the Netherlands, and it is that marshy country PLINY means; for he subjoins these words, *trans Rhenum, maritimo tractu*; which agrees with the account TACITUS gives of the expedition under GERMANICUS.

bad air of the adjacent marshes. Plutarch observes, that after a famine, Demetrius lost 8000 men by a plague. Livy informs us of a like distemper, that seized both the Romans and Carthaginians in Sicily: and Diodorus Siculus describes another plague, attended with a bloody flux, which almost utterly destroyed the latter, at the siege of Syracuse; and explains the cause of it in a full and satisfactory manner. But excepting these, and a few more instances, there remains no account of the diseases incident to the armies of the antients. It may seem strange that Vegetius, in his book de re militari, should write a chapter containing directions how to preserve the health of soldiers, and yet not mention any sickness they were particularly subject to; and that he should speak of the physicians attending the camp, without taking notice of the manner of disposing of the sick, whether in hospitals or otherwise.*

The silence of the antients upon this article is the more to be regretted, that as war was their chief study, it is scarce to be doubted, but that the orders relating to the care of the

* Both the Greek and Roman historians expressed every epidemic and mortal distemper by a *plague*, whether it was a real plague, or what physicians now understand by a malignant or pestilential fever.

P R E F A C E.

sick, were no less perfect than the other branches of their military science. And whereas their troops were constantly in the field, and in very different climates, the physicians of those days had it greatly in their power to have furnished many useful observations on the nature of camp-diseases, as well as about the proper method of treating them.

Nor has this deficiency been supplied, that I know of, by any of the moderns, unless by such as either were little or not at all employed in the service, at least in the hospitals of an army; and who, on that account, cannot be supposed to have written better on this head, than that author on the art of war, who composed his treatise without having ever seen a campaign. So that after all, this part of medicine, which ought long ago to have been complete, is still in a manner new: so little is a military life consistent with that state of tranquillity, requisite for study and observation.

Upon my being first employed in the army, I soon perceived what little assistance I was to expect from books; and therefore I began to note down such observations as occurred, in hopes of finding them afterwards useful in practice. And having continued this method to the end of the war, I have since put those materials

into order, and with as much clearness and conciseness as I could, have endeavoured from my own experience to supply, 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 endemic diseases of the Low Countries (so often the seat of our wars), I proceed to give an abridgment of the medical journal, which I had kept of all the campaigns. In this I mention the epidemics and more frequent diseases of our troops, in the order they occurred, the embarkations, encampments, cantonements, quarters, marches, fixed camps, the changes of the weather, and, in a word, all the circumstances of the army, that seemed to me likely to affect the health, or to afford materials for others to reason differently upon. In this part I have entered little into the description of diseases, much less have I touched upon their cure; reserving both those heads to be considered in a subsequent part of the work. My chief intention here was to collect materials for tracing the remoter causes of military distempers, in order that whatever depended upon those in command, and was consistent with the service, might be fairly stated, so as to suggest proper measures either for preventing, or
pal-

palliating such causes in any future campaign. And I have been the more studious of exactness in these observations, as I foresaw that in whatever manner the whole was to be received, this part, at least, would be acceptable; as it was chiefly 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 at one view.

I have, therefore, thrown most of the reasoning, that results from the first part, into the second; in which, after dividing and classing the diseases common to a military life, I enquire into the more remote or general causes of them: namely, such as depend upon the air, diet, and other circumstances, usually comprehended under the head of the non-naturals. And here I have ventured to assign some sources of diseases, very different from the sentiments of other writers upon this subject; and I have also shewn how little instrumental some other causes are in producing sickness, which yet have been thought of all the most frequent. Nor will this liberty, I hope, be condemned, when it is considered what greater opportunities I have had beyond others to make such remarks; and that, as natural knowledge is daily improving, those au-

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thors, who write last on subjects connected therewith, are most likely to be in the right.

Among the chief causes of sickness and death in an army, the reader will little expect that I should rank, what is intended for its health and preservation, the Hospitals themselves, and that on account of the bad air and other inconveniencies attending them. During the late war, one considerable step was made for their improvement. Till then it had been usual to remove the sick a great way from the army, whereby many were in a manner lost before they came under the care of the physicians; or, which was attended with equally bad consequences, if the hospitals were nigh, they were for the greater security to be frequently shifted, according to the changes of the camp. But the Earl of Stair, my late 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 shew 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

Noailles having occasion to send a detachment to another village, upon the opposite bank, and apprehending this might alarm the sick, he sent over to acquaint them, that as he knew the British hospital was there, he meant them no harm, and had given express orders to his troops not to disturb them. This agreement was strictly observed on both sides all that campaign; and tho' it has been since neglected, yet we may hope, that on future occasions, the contending parties will make it a precedent.

After explaining the general causes of the sickness, in armies, I proceed to point out the means of removing some, and rendering others less dangerous. Without this addition, the former considerations could have been of little use. But it is easy to conceive, that the prevention of diseases cannot consist in the use of medicines, or depend upon any thing a soldier shall have it in his power to neglect; but upon such orders as shall not appear unreasonable to him, and such as he must necessarily obey.

I conclude the second part with comparing the numbers of the sick at different seasons, in order that the Commander may know, nearly, what force he can, at any time, rely upon for service; the effects of short or long campaigns upon the health; the difference between taking the
4 field

field early, and going late into winter quarters; with other calculations, founded upon such materials as were furnished by the late war. The data are, perhaps, too few to deduce certain consequences from them; but as I have not found any other I could depend upon, I was obliged to use these only; which at least will serve for a specimen of what may be done in this way, upon farther experience.

Hitherto, as I have written for the information of officers as well as physicians, I have endeavoured to relate the facts and propose my arguments in as plain a manner, and with as few scientific terms, as was consistent with the nature of the subject; and I hope with as much perspicuity as to be understood by any reader, not unacquainted with the common principles of natural knowledge.

But the third part, containing the practice, is intended for those of my own profession only; as it could neither be rightly explained, nor prove 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 diseases, mentioned there, in a full and regular manner. But at last I determined upon the following course.

I conceive 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 are 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 cursorily pass them over; being satisfied with laying down my general method of proceeding; the difference, if any, to be observed in prescribing in military hospitals; and pointing out the remedies I chiefly relied upon.

But with regard to the other class, including the bilious, and malignant fevers, and the dysentery, as they are diseases less frequent in this country, I thought it proper to handle them more at length; and indeed in so full a manner, as, I hoped, might instruct those who had never seen them before.

My account of the malignant fever was first printed about two years and a half ago, under the title of, Observations on the Nature and Cure of Hospital and Jail-Fevers: in a Letter to Dr. Mead. But as that treatise was hastily published, upon the jail-distemper break-

breaking out at that time *, many things were omitted, and mistakes were made, which I have now endeavoured to supply and rectify. Dr. Huxham's Essay on Fevers came out immediately after ; in which I find so near a coincidence between his account of the malignant fever, and mine, that I imagine it must add no small weight to both our testimonies, to find two authors, in different places, without any communication, vary so little, in either the cause, description, or cure. And from thence we may hope, that, considering how fatal this distemper has sometimes been, such information will excite the attention of the public, to the danger arising from close and putrid air, so common in our jails, ships, naval and military hospitals ; and to the means proposed of purifying such places by ventilators.

To this, as well as to the account of the bilious fevers and dysentery, I have subjoined my conjectures about their more subtle and immediate causes ; tho' I am aware, that an attempt of this kind may rather tend to weaken than to confirm my observations : as we but too frequently see the judgment influenced and perverted by such kind of theories. But the reader may be assured, that not only the de-

* See the account of it in page 290.

scriptions, but the cure of all those diseases were long established, before I thought of assigning these causes; and which, indeed, were sometimes first suggested by the effects of the remedies. Yet, the use of a theory is evident, from the necessity of varying the medicines, oftner than can be taught either by mere empiricism, or even by analogy from other fevers.

I need not acquaint my reader how little of this reasoning is my own. The corruption of the humours is hinted at by Hippocrates, farther taken notice of by Galen; and still more fully treated of by Fernelius, Platerus, Eugenius, Sanctorius, Sennertus, and other celebrated authors about their time. In a word, how imperfectly soever these principles were then enquired into, they seemed to be among the surest of any that were admitted, before the circulation of the blood was known. But soon after, both that important discovery, and the notion of putrefaction were lost in the systems of Sylvius and Willis.

To these last succeeded the mechanical writers, who detecting the weakness of their hypotheses, and believing a few of the mixed mathematical principles adequate to solve all phænomena, began from thence to explain the nature

P R E F A C E.

ture of fevers; either wholly rejecting, or too sparingly admitting chemistry. This error did not escape the learned Boerhaave, who, tho' he retained the use of mechanics, yet revived and reformed the doctrine of acids and alcalies; and under these last comprehended all that he thought septic or putrid. But, as my celebrated master had not time to ascertain every part of his doctrine from experiments of his own, it was no wonder some mistakes were made, and that the extent of these principles 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 retards putrefaction, as most likely to account for many of the more abstruse operations of nature*. My papers upon this subject being read at several meetings of the Royal Society, were left in the hands of the Secretary; but, finding it necessary to make frequent references to those experiments, I thought it proper to annex them to this work, in the same order they were presented; adding only a few notes, and making a few altera-

* Natural History, Cent. iv.

tions,

tions, to explain what might not have been fully or clearly enough expressed before ; and others, by way of connecting those facts with the preceding Observations. If I may direct the reader in the manner of perusing the whole, it would be to examine the Experiments first, or at least previously to the third part of this treatise.

I am sensible, that, notwithstanding all my care and attention in making both the Observations and Experiments, not only many inaccuracies, but mistakes must have escaped me ; which, those will most readily excuse, who having themselves made researches of this kind, are not unacquainted with the difficulties attending them. Yet, however imperfect these sheets may be, I may hope they will serve as a foundation for others to go upon ; who, by making improvements on this subject, will concur with me, in attempting to draw from the calamities of war some benefit to mankind.

P. R. H. A. C. E.

think to explain what ought not have been fully
or clearly enough explained before; and which
by way of connecting the facts with the pre-
ceding Observation. If I may do so, the re-
sult in the manner of forming the result, it
should be to examine the experiments first, or at
least previously to the third part of this tra-

I am sensible, that, notwithstanding all our
care and attention in making these Observa-
tions and Experiments, and our most anxious
search, but mistakes must have crept in;
and, that will most probably cause, also, that
the Experiments made in support of this kind, are
not accompanied with the necessary attending
causes. I am, however, persuaded, that I shall
never be able to say they will serve as a firm
basis for others to go upon; and, by making
experiments on this subject, will come with
me, in attempting to show from the testimony
of our former thought to mankind.

C. O. N.

COO (livr)
magn. in the year 1743, and the ensuing
winter in Flanders.
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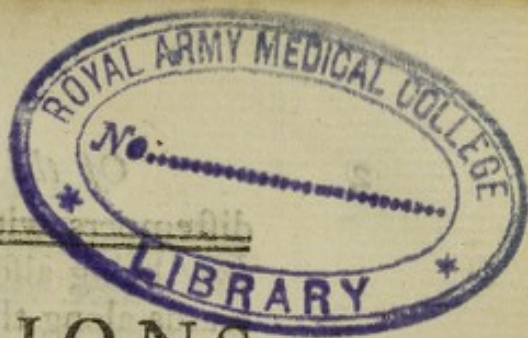
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ERRATA.

Page	Line
3,	ult. dele from.
5,	10, } for <i>with</i> , read <i>by</i> .
32,	30, }
8,	8, for <i>that even</i> , read <i>as if</i> .
11,	9, for <i>embarkations</i> , read <i>passages</i> .
12,	2, for <i>lower</i> , read <i>the low</i> .
44,	24, place the comma after <i>surprize</i> .
45,	24, for <i>these houses</i> , read <i>that place</i> .
46,	4, for <i>town</i> , read <i>the town</i> .
63,	5, for <i>worse</i> , read <i>very bad</i> .
73,	2, for <i>protracted</i> , read <i>as protracted</i> .
86,	23, } for <i>was</i> , read <i>were</i> .
88,	28, }
91,	16, read <i>water of the countries where these, &c.</i>
100,	4, (of the note) for <i>perniciocissimus</i> , read <i>perniciossissimus</i> .
122,	12, dele <i>these</i> .
ib.	14, for <i>will</i> , read <i>they will</i> .
152,	16, for <i>rheumatims</i> , read <i>rbeumatisms</i> .
187,	10, for <i>become</i> , read <i>became</i> .
200,	16, for <i>seems</i> , read <i>seems</i> .
235,	20, for <i>afterwads</i> , read <i>afterwards</i> .
274,	28, for <i>beat</i> , read <i>heart</i> ; and correct the reasoning by the note in p. 223.
311,	19, after <i>liquors</i> , add <i>viz. about two ounces</i> .
340,	10, for <i>sea-salt</i> , read <i>sea-salt</i> .
369,	22, for <i>an</i> , read <i>on</i> .
385,	5, for <i>confists</i> , read <i>confist</i> .



OBSERVATIONS

On the DISEASES of the ARMY in

CAMP and GARRISON.

PART I.

CHAPTER I.

*Of the AIR and ENDEMIC DISEASES of the
LOW COUNTRIES.*

THE river *Lis*, rising in *Artois*, and joining the *Scheld*, at *Ghent*, divides 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 *Dutch-Flanders*, with some barrier towns belonging to the *Dutch*, the *French*, and *Austrians*: of all which, *Furnes* and *Sluys* are the most sickly. But, the remaining part of *Flanders* is higher, and, with the rest of the *Austrian Netherlands*, is altogether a dry and healthful country.

Great part of the *United Provinces* is likewise low and wet, and subject to the same distempers

distempers with *Flanders*: and *Dutch-Brabant* being also marshy, from *Grave* downwards along the *Maes*, and every where incommoded with water near the surface, is subject to the same aquatic diseases. But above all, *Zealand* shares the worst air; as being not only low and watery, but surrounded with the oozy and slimy beaches of the eastern and western *Scheld*, and the most marshy parts of the country: so that almost every wind, except from the ocean, must add 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 no better than a large morass; and even now, after incredible labour, the country is still subject to be overflowed by extraordinary floods, and other casual inlets of water. By the evaporation of this, as likewise of the canals and ditches, in all which innumerable plants and insects die and rot, the atmosphere is filled, during the latter part of summer and autumn, with moist, putrid and insalutary vapours.

A second, but less obvious source of humidity, is from the water under ground; which is every where so near the surface, that a constantly dry ditch, the sure mark of a healthful situation, is never seen, except in the higher lands.

lands. Now, 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 less liable to intermittents, in proportion to the depth of this subterraneous water: so that by looking into their wells, it is easy to determine the comparative health of each village. These wells being fed by the underground-water, and sinking proportionally to the droughts of summer, are at once a proof and measure of the constant exhalation of this water by the sun.

In *Zealand*, and upon the opposite coast of *Flanders* and *Brabant*, is observed a peculiar kind of putrid damp, which rises at low water from a beach covered with slime and mud, more liable to corruption on account of the mixture of fresh and salt-water*. But upon an open and sandy coast, as at *Ostend*, the country is refreshed with wholesome winds from the sea; while at the same time there is reason to believe the exhalations from thence are considerably less than those of marshy grounds†, and never putrid.

But another, and more general cause of the humidity and corruption of the atmosphere, is from an imperfect ventilation. There are

* Vid. LANCIS. de Nox. Palud. Effluv. lib. i. p. i. c. v.

† Hist. de l'Acad. R. des Sc. A. 1741. p. 27.

no hills to receive the winds, or to direct them in streams upon the lower grounds; hence the air is so apt to stagnate; and the more by reason of large plantations made for pleasure, inclosures, or fuel. The farms and smaller villages are crouded with trees, which not only confine, but moisten the air by transpiration. But in towns, where 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 there are continual fires, the aquatic diseases are both fewer and milder.

To these causes of endemics, in flat and marshy countries, must be added the impurity of the common water; which being here either collected from rains, and preserved in cisterns, or drawn from wells extremely shallow, is, in hot and dry seasons, soon corrupted. This being the case, the general tendency to putrefaction may be aggravated by the use of such water; as well as by meats, which in a close, hot and moist air, are quickly tainted. Every thing, therefore, conspires 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 universal cause of a speedy corruption of all animal substances, so it is observed in every country, to produce fevers, and other distempers of a putrid kind, exactly the same,

or

or similar to what occur in the low and marshy parts of the *Netherlands*.

This is the nature of the climate: but according to the various degrees of heat, and moisture of the season, the epidemics begin earlier or later, are of longer or shorter duration, and attended with milder or more alarming symptoms. If the heats come on soon, and continue throughout autumn, not moderated with winds and rains, the season proves extremely sickly, the distempers appear early, and are dangerous. But if the summer is late, or tempered with frequent showers and winds, or if the autumnal colds begin early, then are the diseases few, the symptoms gentle, and the cure easy*.

And here it will be proper to observe, that moist and rainy seasons differ greatly; since in marshy countries, intense and continued heats occasion the greatest moisture in the atmosphere, by the immense exhalation they raise; whereas frequent showers, during the hot season, cool the air, check the excess of vapour, dilute and refresh the corrupted stagnating water, and precipitate all putrid and noxious *effluvia*. But, if heavy rains in the beginning of summer are succeeded by great and uninterrupted heats, those rains, by overflowing the meadows, serve only for matter

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

of more exhalation, make the season more sickly, and the distempers more fatal.

Farther, it is to be remarked, that the sickness never begins till the heats have continued so long as to give time for the putrefaction and evaporation of the water. The commencement, therefore, of the epidemics may be dated from some time in *July*, or the beginning of *August*, under the canicular heats; their sensible decline, about the first falling of the leaf; and end, when the frosts begin. For the rest of the year, it is safe, or at least much less disposed to produce any distemper.

Again, we are to observe, that tho' in the month of *September* the greatest ardour of the season is gone, yet the epidemics continue, by reason of the difference of the degree of heat between the days and nights. The days are still warm, but the nights are cold and often foggy; and it is by these sudden transitions that the perspiration is stopped, and the more putrescent parts of the blood retained, or thrown in the form of a putrid and acrid bile upon the bowels. It is also to be remembred, that the summers are hotter, and the weather more constant, on the continent, than in the same latitude in *Britain*: and lastly, that in the *Netherlands* the heats are more close and stifling, than they are usually felt in hilly countries.

The epidemic of the hot season, and great endemic of this and other marshy countries,

Ch. I. of the LOW COUNTRIES.

7

is a fever of an intermitting nature, commonly of a tertian shape, but of a bad kind; which, in the damper places and worst seasons, appears in the form of a double tertian, remittent, continued putrid, or even an ardent fever *. All which, however varying in type in different constitutions and other circumstances, are nevertheless of the same nature, and proceed from like causes: as a proof, both the continued and ardent fever of that season usually terminate in regular intermittents.

In *Zealand*, where the air is worst, it is called the *gall-sickness*; and, indeed, both the surcharge and depravation of the bile is so remarkable, wherever these fevers prevail, that the first cause has been usually referred to the corruption of that humour. But however that be, it is certain, that the continuance and malignity of the disease is often owing to an increased secretion and putrefaction of the bile, first occasioned by the fever.

In proportion to the coolness of the season, to the height and driness of the grounds, the epidemic appears milder, remits or intermits more freely, and recedes farther from the nature of a double tertian, a continued putrid, or an ardent fever. In its worst state, the effects plainly ascertain the cause; as these fevers are attended with intense thirst and heat, foulness of the tongue, bitterness of taste,

* An ardent fever is defined Part III. Ch. iv. § 2.

desire of acids, *nausea* and aversion to all animal food, putrid vomiting, extreme sense of oppression about the stomach, sometimes with livid spots, and the like strong indications of a putrid bile; if not a corruption of all the humours. And whereas, with such symptoms, the disease assumes an intermitting or remitting form, it should seem, that even the more benign intermittents of this season were owing to a lesser degree of the same cause.

The *cholera morbus*, and dysentery, tho' rarely to be called epidemic, are nevertheless frequent diseases of moist countries. They appear in the same season with the fevers, and seem to be only particular determinations of the corrupted humours; to which, if the first passages give vent, a *cholera* or flux ensues; but if they are retained and assumed into the blood, they occasion an intermitting, remitting or continued fever.

Both fevers and fluxes are often accompanied with worms, which are not to be deemed the cause of either; but only a sign of a bad state of the bowels, brought on by a stagnation and corruption of the aliment, and a weakness of the fibres; all owing to the heat, moisture, and putrefaction of the air.

These are the acute endemics of the marshy parts of the *Netherlands*. The chief chronical distemper is a species of a scurvy peculiar to a moist and corrupted air; the symptoms

symptoms of which agreeing so much with the sea-scurvy, they may be accounted the same disease. The exhalation of the canals and marshes, in hot weather, acts like the vapour which rises from the bilge-water of a ship; both are putrid; and the effects of both are similar*. Here the sea-air is not to be blamed; for, ventilation on board a ship is no greater preservative from the marine scurvy, than removing from the marshes to a dry sea-coast, (as much as to any other dry and sound air) is a cure for the other.

In general, it is the richer sort, or those who can afford to live above the common rate, who keep freest from the diseases of the marshes. For, such climates require dry houses, the apartments raised from the ground, proper exercise, without labour in the sun or in the evening-damps, a just quantity of vinous liquors, and victuals of good nourishment. Without such helps, not only strangers, but the natives themselves are extremely sickly, after hot and close summers. The hardiest constitutions are not more exempted than others, and less in proportion to the driness of the country from whence they come. And this is the reason why *British* soldiers are so liable to bilious fevers and fluxes in the wetter parts of the *Netherlands*.

* The nature of the scurvy is more fully explained in the Appendix, Paper VII. under Experiment xlviii.

Now,

Now, tho' in the lower parts of *Flanders* and *Holland*, the summer and autumnal distempers appear in the extreme, yet in no country, howsoever dry, is there a total exemption. For, the heats, if great, always relax the solids, and tend to corrupt the juices: under which circumstances, if the body is exposed to fogs and nocturnal damps, to any stoppage of perspiration, or receives improper food, the same kind of distempers, tho less characterized and in smaller numbers, will be incident to dry, as well as to marshy countries. Hence, in the driest camps, after great and continued heats, these summer and autumnal fevers and fluxes are constant; because in that situation, besides the natural moisture of a tent, men must either by duty or misconduct be frequently exposed to wet ground, wet cloaths, nocturnal damps and colds. And the subjection to these maladies is the greater, in proportion to the more sensible and frequent interchanges of heat and cold in the field, than in quarters.

But, a sudden stoppage of perspiration, coming upon relaxed fibres, and a putrescent state of blood (arising from a constant exposition to the sun) if not timely remedied, is sure to produce a remitting fever, *cholera* or dysentery: so that these distempers may be called as properly the endemics of a camp, as of a low and marshy country.

C H A P.

CHAP. II.

A general account of the GARRISON DISEASES of the British troops in Flanders, and the cantonements in Germany, in the years 1742, and 1743.

IN the beginning of June (N.S.)* 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 embarkations 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 Train; 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 one general hospital at *Ghent*; but in the other garrisons, the care of the sick was committed to the surgeons of their respective regiments.

During the summer and autumn the weather was good, the heats moderate, and the country, for the season and climate, enjoyed good health. The *British* officers shared in it, but the common men were generally unhealthy; and this seemed to be the reason.

* The new stile is used throughout.

1742. *Ghent* is situated between the high and lower part of *Flanders*; one quarter of it, called *St. Peter's-hill*, stands high above the rest of the country, and in this the barracks, having drains and free air, were quite dry; so that the men who lay there enjoyed perfect health. But the rest, who were quartered in the low part of the town, whose barracks being mostly the ground-floors of waste-houses, without drains, and, of course, very damp, were all sickly. The battalion of the first regiment of guards was a remarkable instance of the difference of quarters; two of its companies lay on *St. Peter's-hill*, the remaining eight in the lower part of the town, in rooms so very damp, that the men could scarce keep their shoes and belts from moulding. In the month of *July*, the sick of this one battalion amounted to about 140*; of which number only two men belonged to the companies on the hill, and all the rest to those in the lower town. But, in the middle of *August*, upon changing the barracks, the sickness suddenly abated. The rest of the garrison suffered much less in proportion; the highest *returns* of the foot at no time exceeding 70 in a

* A complete battalion consisted of 813; but as commissioned officers are not put in the *returns* of the sick, we are only to reckon the full corps at 780. The list of the sick, given in once a week by the surgeon to the commanding officer of the regiment, is called the *return*.

battalion,

battalion, and 40 in a regiment of dragoons*. 1742.
Now as the *returns* include all accidents unfitting a soldier for duty, tho' these numbers were more than triple to 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, diarrhoeas, 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 moreover damper barracks, and suffered accordingly. The remitting and intermitting fevers began in *July*; but in *August* the intermittents were most numerous, which continuing throughout *September*, diminished in *October*, and ceased with the frosts in *November*. These fevers were not only of a worse kind than those at *Ghent*, but the number of the sick was three times greater, and more in proportion died. Next to the fever, fluxes were most frequent; and tho' not always with blood, were generally of the dysenteric kind. It was then observable, that such as lay in the upper stories, kept their health remarkably better than those who were below on the ground-floors.

* This consisted of three squadrons, and each squadron of 158 men, not including officers.

The

1742. The two battalions at *Courtray* were differently lodged; one had dry barracks, the other wet, and this last had double the number of sick throughout the autumn: but the highest *return* did not exceed 70.

Oudenarde is in the higher division of *Flanders*; but the barracks being without drains, and damp, and the situation low, the *Welch 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) there was scarce any distemper at all; and that corps was in such health, when the army marched into *Germany*, that it left not a man behind.

The great number of sick, and the little 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 fevers, often mortal; and the intermittents, or agues, by being prematurely stopped, 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; when such as had been ill in autumn were subject to relapse.

Here

Here the autumnal epidemic ceased, and 1742.
the winter diseases began; which were colds
in various shapes. The most common were
hard coughs, stitches, rheumatic pains, pleu-
risies, inflammations of the lungs, &c. to all
which the soldiers, unused to duty and cold
quarters; and unprovided with cloaths suited
to the climate, and to the season (at this time
particularly sharp) were extremely liable.

Besides these, there was no general ailment,
except the itch; which indeed was so uni-
versal, soon after landing, that many believ-
ed, 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,
it was solely owing to the contagion of a few,
who being infected before the embarkation,
communicated the distemper to their com-
panions on board, or soon afterwards in the
barracks.

*Itch
general*

Such were the diseases most incident to the
troops, before they marched. The less fre-
quent, were dropsies and consumptions;
whereof the former were the consequence of
the autumnal fevers ill cured; and the latter,
the termination of neglected colds.

But of all, the most alarming was a fever
of a malignant nature, very slow, and attend-
ed with a sunk pulse and a constant *stupor*:
yet it was more the newness and danger, than
the number seized, that made it consider-
able. The cause was at first mistaken; but
afterwards,

1742. afterwards, it appeared to arise from the foul air of some of the wards crouded with sick ; and especially of one room, in which a man lay with a mortified limb. This fever was confined to the hospital ; and as it has generally taken its rise from thence, it shall hereafter be distinguished by the name of the *malignant* or *hospital-fever*.

1743. In the beginning of *February*, the troops moved from winter-quarters, and marching into *Germany*, were cantoned in the country of *Juliers* and *Aix-la-Chapelle*. Part of the cavalry, only, 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 was, for the season, favourable, and the troops entered *Germany* in good condition.

Soon after the *Influenza* * passed through the greatest part of *Europe*, and was sensibly felt at *Brussels* ; tho' but little in the cantonements, otherwise, than that many, who, in the preceding autumn had been seized with agues, then relapsed. For other diseases, they were the same as in garrison ; such as coughs, pleurifies and the like, from taking cold in a rigorous season.

From the arrival of the troops at their cantonements, till the beginning of *May*, the weather was extremely cold, with extraordinary snows, which fell towards the end of

* A short fever attended with a violent catarrh.

March,

March, and continued for seventeen days: in 1742. the midst of which the troops left their quarters, and crossed the *Rhine*. The march was long, and the roads deep; but as the men came every night into warm houses, and had good provisions, so few fell ill by the way, that in both marches, from *Ghent* to the cantonements, and from thence to the place of encampment, in winter, or in the worst weather, we did not, in all, lose twenty. In the beginning of *May*, the weather suddenly changed, and the troops encamped on the 17th, at *Hoechst*, on the banks of the *Maine*, in a dry, open and healthful country.

CHAP. 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.

THE ground, tho' naturally good, had 1743. not had time to dry thoroughly since the late snows and rains; and tho' the days were now warm, the nights were still cold, and condensed the vapours. These sudden interchanges of heat and cold, joined to the moisture inseparable from tents, could not but affect the health of troops unused to the field. Many were thereupon seized with inflammatory disorders, of sundry forms.

C

The

1743.

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

This, with little variation, is the course of the first camp-diseases; for the nights being yet cold, and the ground wet, it is easily conceived in what manner men must suffer, who lie in tents, without any covering. Besides, soldiers are frequently exposed to rain, and have not means of drying their cloaths; 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 all highly inflammatory. Fluxes, remitting and intermitting fevers are, during this period, never

never general; and such as occur, are never without great inflammation. 1743.

The cavalry had not near their proportion of sick, and 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-cloaths at night. For the officers, they enjoyed perfect health, as they always do in the first part of a campaign.

*Cavalry
healthier*

On the 22d of June, the army marched to *Aschaffenburg*, where it 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 20. Before this motion of the troops, the sickness had sensibly decreased; and it continued still to decline in the new camp: for, the weakest were already in the hospital, and the rest of the men were inured to the field. Add to this, that the nights were now warm, and there had been no rain to wet the men's cloaths, 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 then wet, and they had no straw for the first night. By these accidents, a

1743. sudden change was made in the health of the army. For, the summer had begun early, and the heats hitherto had been great and constant; but, the free and uninterrupted perspiration, attending those very heats, had as yet prevented them from producing any general sickness. Now the pores were suddenly stopped, the humours became putrid, and in that condition were turned upon the bowels, occasioning an epidemic dysentery; which began at this time, and continued for a great part of the season. In the space of eight days after the battle, about 500 were seized with it; and in a few weeks, near half of the troops were either ill, or had recovered of that distemper. It was common, tho' 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, appeared sooner this season than it did in any succeeding campaign. Now, as its usual time is not before the latter end of summer, or beginning of autumn, its cause has been unjustly imputed to eating fruit in excess. But these circumstances contradict that opinion; for this sickness began and raged before any fruit was in season, except strawberries, (which, from the high price, the men never tasted) and ended about the

the time the grapes were ripe ; which growing in open vineyards were eat by every body. 1743-

To this add the following incident. Three companies of *Howard's* regiment, which had not joined the army, marched with the King's baggage from *Ostend* to *Hanau* ; where arriving a night or two before the battle, and having orders to stop, 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, or 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 air. By means of such favourable circumstances, it was remarkable, that while the army suffered most, this little camp entirely escaped the distemper ; tho' the men breathed the same air, the contagious part excepted, eat of the same victuals, and drank of the same water. This immunity continued for six weeks, until the army removed from *Hanau* ; when these companies joining the main body, and encamping in the line, were at last infected ; but suffered little, as the flux was then so much upon the decline.

The dysentery raged 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

1743. heats returned, and continued for some weeks so great, that the humours, already too much 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, the sickness visibly abated.

The numbers aggravated the symptoms, as in the case of the small pox, plague, and every other putrid and infectious distemper. But, the flux is particularly destructive in full hospitals, where the corrupted steams being confined and accumulated, are raised to a high degree of virulence: of which fact the present sickness afforded a fatal instance.

The village of *Feckenheim*, about a league from the camp, was taken up for an hospital; into which, during the stay the army made at *Hanau* (besides the wounded from the field of battle) about 1500 sick were sent from the camp; and of that number the greatest part ill of the dysentery. By which means the air became vitiated to such a degree, that not only the rest of the patients were seized with the flux, but the apothecaries, nurses and other attendants, with most of the inhabitants of the village, were also infected. To this acceded a still more formidable disease, namely, the *hospital* or *jail-fever*, an inseparable attendant of foul air from crowds and animal corruption. These two combined occasioned a great mortality: while

while on the other hand, such as were seized 1743. with the dysentery, and not removed from the camp, tho' wanting many conveniencies, others had in hospitals, kept free of this malignant fever, and commonly did well.

On the 10th of *August*, the army decamped from *Hanau*, and came to *Wissbaden*; where we lay some days, and were joined by four battalions from *England*. On the 23d, we crossed the *Rhine*, and on the 30th of the same month, encamped at *Worms*, along the river; where we continued until the 25th of *September*. All the encampments were on dry ground, and in an open country.

The month of *August* was still warm and dry, without fogs; and the rest of the autumn was fine, allowing for the abatement of heat, and the usual dews of this season. In the end of *August*, tho' the days were still hot, the nights grew cool; and in the beginning of *October* the cold was so far advanced, that the fields were sometimes covered with a hoar-frost.

From the time of removing from *Hanau*, there was so remarkable a decline of the dysentery, that the change could be only imputed to the leaving behind the infectious privies, the foul straw, and filth of a long encampment. When the army crossed the *Rhine*, this distemper made but a third of all the sickness, from having been lately almost the only complaint. In a month after

1743. it was scarce seen, unless in a few; who by reason of imperfect cures, colds, or errors of diet, chanced to relapse.

About the middle of *August*, when the dysentery was on the decline, a new disease appeared, and which daily increased, as long as the troops kept the field. This was a remitting fever; the paroxysms of which came on in the evenings, with great heat, drought, a violent head-ach, and often a *delirium*; all which symptoms lasted most of the night, but abated in the morning with an imperfect sweat; sometimes with an hæmorrhage of the nose, or a looseness. The stomach was, from the beginning, much disordered with a *nausea* and sense of oppression, frequently with a bilious and putrid vomiting. If evacuations were either neglected, or too sparingly used, the patient fell into a continued fever; and sometimes grew yellow, as in a jaundice. When the season was far advanced, so that colds became frequent, the fever was attended with a cough, rheumatic pains, and fizy 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 a-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 bad lodgings. This distemper,

distemper, another constant epidemic of an 1743. army, shall hereafter be distinguished by the name of the *bilious*, or *autumnal-remitting fever*.

In the course of the dysentery, and even of this fever, several voided round worms; and the same symptom has occurred in both, every campaign. But we are not, therefore, to imagine, that these worms are the cause of the fever or flux*; but only, that when joined to either, they make them worse.

On the 25th of *September*, the army, free of the dysentery, but with a daily increase of the remitting fever, marched to *Spiers*; but returned on the 13th of *October*. The weather had changed, and it rained much during the march; which, with the coldness of the season, caused, in that little time, so much sickness, that when the troops came back, above 800 more were sent into the hospital, and almost all of them ill of this fever. Three days after, the army moved to *Biberic*, and breaking up camp, on the 25th of *October*, the *British*, in different divisions, returned to the *Netherlands*. The weather being extremely favourable to the march, (which continued a month) and the men coming into warm quarters every night, so few fell ill, that they arrived at their several garrisons with scarce the loss of a man.

* See ch. 1. p. 8.

But

1743. But 3000 sick were left in *Germany*; part at *Feckenheim*, near *Hanau*, and the rest at *Osthoven* and *Becktheim*, two villages in the neighbourhood of *Worms*. The state of those at *Feckenheim* has been already mentioned: there the malignant fever and dysentery grew daily worse. Few escaped; for, how mild or bad soever the flux was, (for which the person was sent to the hospital) this fever almost surely supervened. The petechial spots, blotches, parotids, frequent mortifications, contagiousness, and the great mortality set forth its pestilential nature. In this it was worse than the true plague, as there was no security against a relapse; but, on the contrary, almost a certainty of it, if the person continued in the infectious air. 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 the fever by contagion, between the two were almost utterly destroyed.

The condition of the two hospitals near *Worms* was better; there the sick had more space, they had been admitted in a cooler season, and the distempers were less putrid. But, one general hospital being to be made at *Newied*, the sick were removed from their several quarters, and carried down the *Rhine* to

to that place; where, by the change of air, 1743. those from *Eschenheim* were indeed at first relieved, but the rest, who 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 about the middle of *December*. So that, in this tedious voyage, the fever having acquired new force by the confinement of the air, mortifications, and other putrid *effluvia*, it was raised to such an extraordinary pitch of virulence, that above half the number died by the way, and several more soon after their arrival. The resemblance of this distemper to a true pestilence, was farther evinced by this remarkable incident. A parcel of tents were sent on board the same bilanders with the sick, and which being to be refitted, were put into the hands of a tradesman at *Ghent*, who employed twenty-three journeymen about the work; but those unhappy men were quickly seized with a malignant fever, and seventeen of them died.

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 all

1743. all which, *Brussels* is the highest and best aired. But in winter, as there is little exhalation, and consequently no dangerous moisture in the air, the situation of the place is a matter of less consequence; so that the only concern is to have warm and dry barracks, with a sufficient allowance for fuel. The best quarters were at *Brussels*, and accordingly the sickness was nothing there, in comparison to what it was at *Ghent* and *Bruges*; where the dampness of the barracks, conspiring with some remains of the diseases of the field, occasioned frequent distempers in the beginning of winter.

For, tho' the troops returned to *Flanders* in apparent good health, yet, soon after their arrival, several were taken ill with remitting fevers, attended with inflammatory symptoms; whereby it appeared, that the seeds of this fever might lie some while latent in the body, and break out upon catching cold, before the frosts have recovered the tone of the bowels, braced the fibres, and purified the blood.

In the beginning, therefore, of winter, these remittents were the prevailing disease of the garrison; and there were besides jaundices without any fever. At *Brussels*, where the barracks were dry and warm, the fevers were few, and the jaundice rare: but at *Ghent* and *Bruges*, both were numerous. Yet the continuance of the fever was short; for,
it

it disappeared in *December*, nor was succeeded by any other disorder, but coughs and inflammations from colds; exactly as in the preceding winter.

No epidemic appeared in the spring. The only disease, besides colds, was the malignant fever, which came from *Germany*, and was still fatal in the hospital at *Ghent*. And some degree of the same distemper was also felt at *Bruges*, in the regimental infirmaries, which had been too much crowded, upon the troops coming first into winter-quarters.

CHAP. IV.

A general account of the DISEASES of the campaign in Flanders, in the year 1744.

OUR troops first encamped at *Anderlecht*, within a league of *Brussels*, on the 13th of *May*. On the 1st of *June* they moved to *Berlegbem*, and lay there till the 31st of *July*; when the army crossed the *Scheld*, encamped at *Anstain*, in the territory of *Lisle*, and remained there almost all the rest of the campaign.

The *British* took the field with five new battalions, and at *Berlegbem* there was a reinforcement of five more from *England*; which, with the *additional*s to the dragoons, and recruits, made the national troops exceed in

1744. in number those of the former campaign, 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 turned mild, and keeping dry without excessive heat, the summer proved in general very favourable for the field. Before the army passed the *Scheld*, there having been no hard duty, and the forage being at hand, the men suffered little by wet cloaths or fatigue; hence the sickness was so moderate, that during ten weeks encampment, our troops had sent little more than 600 into the hospitals of *Ghent* and *Brussels*: which was not above $\frac{1}{43}$ part of the whole.

Two thirds of these cases were merely inflammatory, being either pleurifies, peripneumonies, quinsys, rheumatisms with fevers, or the like. For the rest, they were mostly vernal agues, with a few fluxes, and other casual distempers: and these likewise with inflammation, as in the beginning of the last campaign*.

Now as to the inflammatory diseases of a camp, it may be proper once more to observe, that upon first taking the field, coughs and stitches, with inflammations of the lungs and *pleura*, are the common effects of catching cold; but that towards the summer-solstice, as the weather grows warmer, the

* Ch. III. p. 18.

breast is less liable to be affected, and the colds are rather productive of a continued fever, with sily blood, than of any of the above-mentioned inflammations. And also, 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 continuing in camp, or being carried in waggons to distant hospitals, is never without danger.

After the army came into the territory of *Lisle*, an hospital was opened at *Tournay*, on the 23d of *August*; into which were at first sent but 50 sick: and these being all that were taken ill, since the troops crossed the *Scheld*, were a proof how healthful the camp then was. But in this small number there appeared a change in the distempers, from inflammatory to bilious: most of the cases being 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 were out on foraging-parties, were not only often wet, but the ground whereon the foot encamped, being low, retained the rain-water. Hence, by the 1st of *October*, there were, in the hospital, above 450 ill of the dysentery; besides the slighter cases remaining in the camp.

This, however, was the height of the distemper; which, considering the number of our troops, was as nothing, compared to its
fre-

1744. frequency in the former campaign. The reason was plain ; the last summer had been so hot, that by the end of *June*, the humours had already acquired a high degree of acrimony ; in which state, the rains at *Dettingen* giving a sudden and general check to perspiration, many were then seized at once ; and from thence sprung the infection, kept up by hot weather, and the privies of a long encampment : whereas, by the temperature of this summer, the dysentery did not appear till late, and then could make no progress for want of heat.

The remitting fever of the camp, more regular in its appearance than the flux, began but a little later than it did in the preceding year, was frequent in the end of *September*, but was at no time so general as before. The symptoms were also more moderate, tho' similar ; there was seldom any yellowness, as in the former campaign ; but when the weather grew cold, it was often joined 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 only accessions to it from extraordinary colds.

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

* Ch. III. p. 24.

increased

increased, had not the campaign ended soon after. For, on the 16th of that month some of the troops were sent into winter-quarters, and in a few days more, they were followed by all the rest.

On breaking up, there were about 1500 sick in the hospitals at *Tournay*, *Ghent*, and *Brussels*: which made only the 17th part of all that took the field. The amount of the deaths during the campaign, and of those who were left in hospitals at the end thereof, 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 *Anslain*, and the early retreat into winter-quarters, all concurred in preserving the health of the army.

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

The *British* returned to the same garrisons they left. At *Brussels*, the general hospital was kept up; but at *Bruges* and *Ghent*, none were appointed: the regimental surgeons getting barracks for their sick, with an allow-

1744. ance of medicines, and all other necessaries, at the publick expence. In each of these garrisons was stationed a physician, to whom the surgeons were to apply occasionally for assistance. Which scheme of separate regimental infirmaries, tho' only intended to save the expence of one common and great one, answered another purpose; which was that of preventing infection, the common and fatal consequence of one large and crouded hospital.

At *Ostend* remained two battalions, which having garrisoned the town during the campaign, had enjoyed good health; with the exception of a few regular agues. The remitting fever was unknown, and the intermittents, with a few gentle fluxes, were confined to the soldiers only, who by reason of out-guards and night-duty, were most exposed to colds and wet. But as a proof of the healthfulness of the place and season, neither our officers, nor the people of the town, had any distemper among them.

CHAP. V.

A general account of the DISEASES of the campaign in Flanders, in the year 1745.

1745. **O**N the 25th of *April*, the *British* troops took the field, encamping again at *Anderslecht*; and on the 9th of *May* the army came up to *Briffœel*.

The

The weather being mild, the sickness was moderate; and altogether like that of former campaigns. Inflammatory disorders were common, and, as before, mostly in the shape of a pleurisy, or peripneumony: not so often in the form 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 only new disease was the small-pox, which came from *England* with the recruits, but did not spread: and at no time have we known it of any consequence in a camp.

The battle of *Fontenoy* was on the 11th, on which day the weather was fair, and the following night so dry and mild, that tho' most of the men lay without cover, and all had been extremely fatigued, yet no sickness ensued. Next day an hospital was made at *Ath*, in the cazernes of *St. Roc*, which took in about 600 wounded.

On the 16th of the same month the army removed from *Ath*, and encamped at *Lessines*; where it 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, tho' little affecting the old and hardened troops, were severe on

1745. *Price's* and *Mordaunt's* regiments; which, with the *draughts*, were all new, and had for the first time encamped at *Leffines*.

From this place the army moved to *Grammont*, where it staid ten days; and from thence marching to *Brussels*, encamped on the plain of *Dieghem*; which being a dry, open, and elevated field, is reputed the most healthful ground for a camp in the *Netherlands*. From hence, after a month's stay, the army moved to *Vikvorde*; where the soil being still dry, the country airy, and the heats temperate, the men continued to enjoy extraordinary health. For, in the middle of *September*, few battalions returned above 12 sick altogether; which was as low a number as could be expected in the best quarters.

The temperature of the weather, the dryness of the ground, and the little fatigue the troops underwent, conspired to make the autumn, naturally a sickly season, extremely healthful. The dysentery had been only frequent in the new regiments, and was easily cured: neither could the remitting fever ever be called epidemic. For, tho' it began about the end of *August*, and was the most frequent disease through the rest of the campaign, yet it was so inconsiderable, that no battalion at any time returned above seven or eight ill of that distemper; and those with milder symptoms than had been seen in former campaigns.

It

It was observable, when the troops made another small remove, to form a line along the great canal, the ground being low and close-planted, the effects of moisture began presently to appear: but upon returning to the former camp these were no longer seen.

On the 24th of *October*, the weather still continuing fair and temperate, the camp broke up, and the troops went into winter-quarters. Some time before this, 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 of our troops: the state of the separate corps was as follows. In the end of *August*, *Ostend* having surrendered, the garrison, consisting of five *British* battalions, was conducted to *Mons*; where they staid about three weeks. These men had been so healthy, that when they retired upon the capitulation, notwithstanding the fatigues of the siege, they left only ten sick: but the same corps being put into damp barracks at *Mons*, whilst the town itself was surrounded with an inundation, the autumnal diseases prevailed so much, that in that short time, 250 were taken ill, and left behind when the rest marched to *Brussels*. The cases were dysenteries, remittents, and intermittents; and to

1745. these fevers, as it is usual towards the end of autumn, coughs, rheumatic pains, and other symptoms of cold were joined; not without some mixture, as it appeared, of the hospital fever, acquired by the close and bad accommodation they had at *Mons*.

Handyside's regiment, another detached corps, which had come over this summer, was, about the middle of *July*, sent into the citadel of *Antwerp*. The air of that city is moist, and the fort is particularly exposed to the damps of the neighbouring marshes. The barracks were, moreover, on ground floors, and extremely damp; in consequence whereof the dysentery, together with remittents and intermittents, of a bad kind, became general. In the beginning of *October*, 163 were returned sick from that battalion only; which was five or six times more than any other regiment had in the *line*. This extraordinary disproportion may, in part, be imputed to the newness of the men, but much more to the damps; since the other new regiments, that were then in camp, suffered very little; and in the town itself, fluxes, remittents and intermittents were also frequent among the inhabitants, whilst the people of *Brussels* enjoyed perfect health. When *Ghent* was taken, part of *Rich's* dragoons having escaped from thence, retired to *Antwerp*, and were seized with the epidemics of that place; whilst the remainder of this regiment, which lay

lay in camp, continued entirely free of both 1745.
fever and flux.

Upon the whole, when the campaign ended, there were left in the several hospitals of *Antwerp*, *Brussels*, and *Mons*, about 1000 sick, including all cases: a very small number, considering that during this campaign, there had been at one time in *Flanders*, besides the cavalry, 29 battalions, whereof some had never before taken the field. The deaths from the beginning to the end of the campaign, exclusive of those who were killed in battle, or died of their wounds, did not exceed 200. In both this and the last summer the heats were moderate, the troops were little harrassed by fatigues, and, in general, little exposed to wet cloaths or damps; and the return to winter-quarters being early, were so many concurring circumstances to make this, of all, the most healthful campaign.

CHAP. VI.

A general account of the DISEASES of the campaign in Great Britain, 1745, and 1746.

A Little before 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

1745. the field before the nights turned 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, arrived sickly at *Newcastle*, *Holy-island* and *Berwick*. For, some of the men, during the voyage, fell ill of remitting fevers, which, by the crouds and the foul confined air of the hold, were soon converted into a malignant form.

An hospital was made at *Newcastle*, in which the sick, as they landed, were lodged ; and this house also taking in those that fell ill in the army commanded by marshal *Wade*, the air soon became corrupted and infectious. Not only the nurses, and those who were constantly in the wards, were taken ill, but also the medical attendants, tho' less confined to the putrid air : insomuch that three of the apothecaries of that place, with four of their apprentices and two journeymen employed, were seized with the contagion, and died.

Ligonier's and *Price's* regiments landed at *Holy-island*. These had embarked in perfect health, after leaving all their sick at *Antwerp* ; but before they arrived they were in the same condition with those that came to *Newcastle*. The disaster was unforeseen, and unprovided for. Ninety-seven were taken out of the ships ill of the malignant fever, whereof forty died ; and the people of the place receiving

ceiving the infection, in a few weeks buried 1745.
fifty; which was a sixth part of the inhabitants of that small island. The same fever was carried into *Berwick*, by the soldiers that 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,* assembled at *Litchfield*. The *Quakers* had made a present of flannel under-waistcoats to the men; which was a seasonable provision for a winter campaign. 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 kept their health better than could be expected in that season.

Towards the end of *December* most of the infantry were sent into quarters, whilst the cavalry and 1000 foot advanced to *Carlisle*. The sick, as they fell ill, were left in the towns on the road, to the care of the surgeons and apothecaries there, and were well treated.

The troops having staid some days at *Litchfield*, a greater number of sick was left in that place than in any other; on which account the work-house was fitted up for an hospital: but there being too many admitted, the air
was

* of *sumbert*.

1745. was corrupted, and the common inflammatory fevers putting on a malignant form, several died. But at all other places where the men were taken ill, and where there was no common hospital, that fever and mortality was unknown.

The autumnal remitting fever, disguised with many symptoms of cold, could be traced in the troops which came over from *Flanders*, until the frosts in *December* put an end to it. But the prevailing distempers were hard coughs, stitches, pleuritic and rheumatic pains, with a few fluxes, the natural consequences of exposition to colds and rains on duty, or of wet feet on the march. There were besides some intermittents, but all with such a mixture of coughs and infarctions of the lungs, as made bleeding the most necessary remedy. In general, large and repeated bleedings were so requisite, that in every town through which the troops past, and where sick were 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 bleedings: for, the men were at this time well fed, and by the colds their blood soon became extremely fizy.

Carlisle was invested in the beginning of *January*, and taken in a few days. The shortness

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; tho' there had been in all between 600 and 700 sick. 1746.

On the 10th of *February* the army, under the command of H. R. H. the Duke, marched from *Edinburgh* to *Perth*. It consisted of 14 battalions, and three regiments of cavalry; which being too large a number to be all billeted in so small a place, two battalions were quartered in churches. Provisions were in plenty, but the quarters were generally cold; so that a great many fell ill of the common inflammatory diseases of winter. The hard coughs in particular, with inflammations of the *pleura* and lungs were most frequent.

In the beginning of *March* the troops removed from *Perth* to *Montrose*, and from thence to *Aberdeen*, leaving 300 sick behind; who were all well accommodated in the corporation-halls, or in the private houses of these towns.

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

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1746. The weather being all this time extremely sharp, with frost and snow and easterly winds, the inflammatory diseases continued. But whilst the men suffered by cold beds, guards and out-duties, or by their own mismanagement, the officers escaped, who had warm quarters, and were less exposed to cold: only in the beginning of *March*, when the weather was very piercing, some of them were seized with the gout.

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 sick 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 it passed the *Spey*; and on the 27th*, after the battle of *Culloden*, the troops 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 early, and many colds were taken from wading the rivers: all these circumstances concurred to make the sickness considerable. Before the army reached *Inverness*, about 60 or 70 men were taken ill, and left in towns by the way. After the en-

* N. B. The new style is continued.

campment,

campment, the inflammatory diseases still increased; and which were the more severe, as the season was early, the climate cold, and the camp exposed in an open country to piercing winds. The pleurifies and peripneumonies, in particular, were violent, and tended quickly to suppuration.

At *Inverness* two malt-barns received the wounded, which were in all 270. There were many with cuts of the broad-sword, till then uncommon wounds in the 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 gun-shot wounds, to obstruct a good digestion.

Besides the wards for the wounded, two well-aired houses were turned into hospitals for the sick. The regimental surgeons had, moreover, orders to provide quarters for the men as they were taken ill; with the liberty to send to the general hospital such a proportion of the worst cases, as might lessen their labour, without crowding these houses. By this dispersion of the sick, and the preservation of a pure air in the wards, it was hoped that a contagion might be moderated, if not prevented; and which otherwise more than ever impended, by reason of 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

1746. crouds 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 town before the arrival of the army.

All these circumstances concurred to make us apprehend the worst; wherefore great care was taken in having the sick divided, and their wards kept clean. An order was likewise given to clean the jails every day, to remove speedily the bodies of those who died: and to prevent crouding, part of the prisoners were put on board some ships lying in the road, with a liberty of coming upon deck for the air.

In this manner the month of *May* past over without any infection; and the weather for the season being unusually dry and warm, the inflammatory sickness in camp had visibly declined, when an unforeseen accident rendered all precaution fruitless, and made the malignant fever more general and fatal than had been at first apprehended.

For, about the end of the 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 into the hospital with fevers, and were blooded largely upon admission. But next day, not observing the coughs, stiches and rheumatic pains, the common symptoms of the fever at that
time

Ch. 6. CAMPAIGN in BRITAIN.

47

time prevailing in the camp; and finding 1746.
that the bleeding had sunk the pulse, and
that some had an uncommon *stupor*, the
physician immediately referred this fever to
the malignant kind; concluding it had taken
its rise from the confinement and bad air of
the ships during the voyage: yet he thought
it strange, that this battalion, and none of
the rest, should be so sickly.

But upon farther enquiry, he was inform-
ed, that this fever came directly by contagion
from the true jail-distemper, communicated
in the following manner. Some months be-
fore, a *French* ship had been taken off the
coast of *England*, on board of which were
troops, sent to assist the rebels; and, in that
number, a few *English* soldiers, who had for-
merly deserted to the *French* in *Flanders*.
These men, upon being taken, were thrown
into jails in *England*; where they were kept
till an opportunity offered of sending them by
the transports, to be tried by a court-martial
at *Inverness*. The prisoners were thirty-six
in number, and having brought with them
the jail-fever, gave it to this regiment,
with which they were embarked.

In three days after coming on shore, six of
the officers were seized with it; and the re-
giment, in the few days they quartered at
Nairn, left about 80 sick; in the ten follow-
ing they were in camp at *Inverness*, they sent
into the hospital about 120 ill of the same
fever:

1746. fever: and tho' the virulence of the distemper diminished in their march afterwards to *Fort-Augustus*, and from thence to *Fort-William*, yet that corps remained for some considerable time very sickly.

The symptoms of the jail-distemper were in every point so like those of the hospital-fever, that, as they were but conjectured to be the same before, they were now proved to be really such. 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 number and acuteness. The weather being all the month of *May* not only dry, but warm for the climate, the camp at this time abounded in those diseases only that always attend the beginning of a campaign; except in having fewer agues, and many more diarrhœas. For, these last accompanied almost every disorder, but were slight, and seemed not to be so much the effects of colds, as of the river-water which comes out of *Loch Ness*, and has always been accounted laxative to such as were unused to drink of it. These fluxes either went off of themselves, or soon yielded to astringents.

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

The

The new encampment was made in a little valley, close by the fort, at the end of Loch Ness, and surrounded by mountains, except where it opened upon the lake. This is a large body of fresh water, twenty-four miles in length, and about a mile broad, contained between two parallel and streight ridges of mountains, and affording the prospect of a vast canal. It is curious on account of its great depth, and never freezing. The common soundings are from 116 to 120 fathoms, and in one place they reach to 135. The water is perfectly soft and sweet, and readily bears soap: yet, to some, it proves laxative, and is always diuretic. The people of the country recommend it in 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 the bottom may be covered with the like. But, whether the water is preserved from freezing by some mineral principle, its vast depth, or some hot springs, is uncertain†. As it is well stored with large and good

* *Viz.* In scurfs and lesser degrees of the *lepra*, which are commonly, but improperly, ranked among the *species* of the scurvy. *Vid.* Part III. ch. vii.

† It is most 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

1746. good fish, and is without any particular taste, it should seem to be little, if at all, impregnated with any mineral. And, besides that it is always cool, there is the less reason to ascribe the heat to any spring at the bottom, as none of that kind are to be found any where else in the country. The lake is fed by four small rivers, which are all liable to freeze; and empties itself by the *Nefs*, a large clear river, which, after a course of six miles, runs into the *Frith of Murray*, at *Inverness*; and, like its source, is never known to have ice.

Fort-Augustus has always been a healthy garrison, but *Fort-William*, which lies on the west coast, has ever been sickly; and in particular, subject to agues and the bloody-flux. On that part of the island, there are continual rains; and the fort stands in a narrow and moist valley, surrounded by mountains: so

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 cold of the air; and therefore that the surface of *Loch Nefs* may be kept from freezing by the vast body of water underneath, of a degree of heat considerably higher 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 very much obstruct the freezing of the water. This account seems to be confirmed by an observation, commonly made in the neighbourhood, that is, when the water is taken out of the lake, and kept without motion, it then freezes as soon as any other.

that

that there is not only a greater fall of rain, 1746. but a slower evaporation there than in any other part of the country.

There being no straw at *Fort-Augustus*, the men were ordered to cut the heath and use it 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.

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 which change the dysenteries began to be more frequent; but there being likewise continual winds, to keep the ground moderately dry, and to prevent the increase of the distemper by contagion, it never became general.

The flux, with every other disease of this camp, being attended with fizy blood, and other marks of great inflammation, made large and repeated bleedings more necessary here than in a warmer climate. But vomits were not so efficacious here in curing the dysentery as they had been abroad; tho' at this time they were of greater service than they had been in the spring: a proof, that even in this latitude, some degree of corruption of the humours could be traced in summer.

Besides the dysenteries, there were fluxes of a milder kind among the soldiers, proceeding

1746. ceeding either from errors of diet, wet feet, or wet cloaths; or accompanying fevers, when, from wanting sufficient covering, the sick could not be relieved by sweating.

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

The intermittents partook both of a bilious and inflammatory nature; and therefore required both bleeding and evacuations of the *primæ viæ*. But they never were numerous, as the constant winds prevented a moist air, and soon dried the ground after rain.

In this camp we had no accommodation for the sick, but in a few small huts in the neighbourhood. Bad air being thereupon apprehended, as many as could be transported were sent to *Inverness*: by which precaution the hospital-fever was retarded, but not prevented. For, when the sick multiplied, these infirmary-huts were soon crowded, the air was vitiated, the distemper broke out, and was fatal. And when the malignant fever was joined to any common inflammatory disease, a mixture of the two arose, which made the most perplexing cases; as the indications of cure were so contradictory.

In

In the middle of *August* the camp broke up, leaving at *Fort-Augustus* between 300 and 400 sick, which were afterwards transported to *Inverness*. By this time the hospital-fever was frequent among the inhabitants of that town, but was less mortal than usual, on account of the coolness of the weather, and 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, including the wounded; of which number near 300 died, and mostly of this malignant fever.

CHAP. VII.

A general account of the DISEASES of the CAMPAIGNS in Dutch-Brabant, in the years 1746 and 1747.

THIS was the state of the health of the troops in *Britain*. In the *Low-Countries* there had been from the beginning of this campaign, only three battalions and nine squadrons *British*. In the month of *August* four 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 presently afflicted with the bilious remitting and intermitting fevers

1746. of the country; and were obliged, before they marched, to send a great many sick into the hospital at *Oosterhout*.

This campaign being attended with several fatiguing and wet marches in autumn, after a warm summer, and continuing late, proved very sickly. For at the end thereof, exclusive of the wounded from the battle of *Rocoux*, about 1500 of our men were in hospitals, which made nearly a fourth part of the 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*. The *British*, consisted at first of 15 battalions and 14 squadrons; and some time after, seven battalions more were sent from *England*: but four of these being employed in *Zealand*, and three in the lines of *Bergen-op-Zoom*, they never joined the army.

The first days of encampment were extremely 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.

* As the author attended the army in *Scotland*, during this campaign, he could give no more particular account of the diseases of the troops employed in the *Low-Countries*.

In the first six weeks about 250 were sent into hospitals; a moderate number, considering how early the troops had left their quarters. The diseases 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 into *Maestricht*; where, among other places, a large church was employed for an hospital, which not only accommodated a great number; but, by its spaciousness prevented, throughout the season, the hospital-fever, tho' many that were ill of fluxes and other putrid diseases lay in it.

After the battle the army crossed the *Maes*, and encamped at *Richolt*. Some time after they moved to *Richel*, and afterwards to *Argenteau*; but still kept in the neighbourhood of *Maestricht*. The situation of all these camps was dry and airy; and there being at first no extraordinary night-duty, the distempers were few, and but little inflammatory. The dysentery did not yet appear, unless among the guards, which, at *Richolt*, happened to encamp 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

1747. as hot as the days. During all that time the camp was healthy, but the wounded suffered; for, the extreme heat either brought on putrid fevers, or, by relaxing the fibres, and 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*, tho' the days were still hot, yet the nights began to cool, and frequent dews to fall; and from such interchanges, to which the men in camp were continually exposed, the dysentery took its rise: as it usually happens upon the perspiration being checked by damps, after the humours have become acrid by the heat.

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

Notwithstanding the violence and frequency of the flux, few died of it; for the sick were more dispersed, the hospitals were better aired than usual, and the regimental surgeons having learned by experience, either

per-

perfectly cured the men in their field-hospitals, or made some necessary evacuations before they sent them into *Maestricht*. 1747.

In the beginning of *October*, there fell a great deal of rain, and such of the men as happened to be exposed to it, were seized with the dysentery: but to the army, in general, it was a favourable circumstance, as it cooled the air, and thereby soon put an end to that distemper.

About this time the autumnal-remitting fever, which had appeared about the end of *August*, became frequent; but with nothing new, either in 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 by themselves, or combined with the remitting fever.

On the 12th of *November* the troops got into winter-quarters.

Tho' there had been much sickness during the campaign, there was little mortality; and at the end of it, considering how late it then was, the numbers sent into the hospital, from the main body, were moderate.

But in *Zealand*, the sickness was excessive among the four battalions, that had been there since the beginning of the campaign. These, partly in camp and cantonments, lay in *South-Beveland* and in the island of *Walcheren*,

1747. *cheren*, two districts of that province; and both in field and 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 a seventh part of the battalion. That of 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 *Zeeland*, with its effects in producing bilious remitting and intermitting fevers and fluxes, having been already shewn*, it will be sufficient to refer to that place for a general account of these distempers; and for a more particular one, to the third part of this work †. I shall only observe here, that these epidemic fevers, by reason of the great heats of the season, not only began more early than usual, but were more severe, and fully as fatal to the natives as to us. The officers were also sickly; tho' from more timely and greater care, their fevers were attended with less ardent and malignant symptoms, than those among the common men. But commodore *Mitchell'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 distempers raged, was neither afflicted with fever nor 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

* Ch. i. p. 6, 7, 8.

† Ch. iv. §. 2.

it could reach them; and that a situation 1747.
open to the wind, is one of the best preservatives against the maladies of a neighbouring low and marshy country.

In proportion as the autumn grew cool, these fevers abated of their ardour, and formed more easily into intermittents; tho' still 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 had both, it was alternately; so that when the flux appeared, the fever ceased, and when the first was stopt, the other returned: whence it appeared, that tho' the two distempers were of a different form, they proceeded from a like cause.

As to the three other battalions, that 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 gentle eminence, but the country around it being in some parts marshy, the air, tho' not so moist as in *Zealand*, was less pure 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 mild remitting fevers of the camp. And if the dysenteries were more frequent in the
lines

1747. lines of *Bergen-op-Zoom* than in *Zealand*, the reason was, that the men, on this duty, were oftner exposed to rain; and by being in a large and fixed camp, had the distemper more by contagion.

At the end of the campaign there were in hospitals, from the main body of the *British* troops, and all detachments, (exclusive of the wounded) above 4000; which was something more than a fifth part of the whole number. But it is to be remarked, that the four *Zealand* battalions furnished near one half of these: so that when these went into winter-quarters, their sick were in proportion to their men in health, nearly as four to one.

CHAP. 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 very 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 taking the field, till the beginning of *May*, the weather was extremely cold, with some snow, high winds and rain; but the duty was little, and the ground naturally dry.

On the 12th of *May* the army left *Hillenraet*, and in a few days came to *Nistelroy*, where

where we encamped for the last time ; leav- 1748.
 ing in the hospital at *Cuick* about 500, and
 these, as usual, mostly inflammatory cases.
 There was an uncommon number of inter-
 mittents, which were not all original cases,
 but generally relapses in those men, who, in
 the preceding campaign, had been seized
 with fevers in *Zealand*, and in the lines of
Bergen-op-Zoom. And these too, through
 the coldness of the season, were also attended
 with some degree of inflammation.

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

The weather was now warm, and the days
 often hot ; but some seasonable rains, with
 thunder and lightning, prevented sultry heats,
 and purified the air of its most insalutary
 parts. For, it has been remarked of thun-
 der, that as it is most frequent in close and
 marshy countries, it may have, for a final
 cause, the cooling and correcting the putre-
 scency of the air, when the heats are most in-
 temperate*. The ground was also dry, and
 the camp airy ; so that the sickness was in-
 considerable, as long as the troops kept the
 field.

From this good state of health the four
 battalions, that had been last campaign in
Zealand, were an exception. For, these were
 very subject to relapse into irregular agues,
 terminating in dropries. So that their sick

* MUSSCHENBROEK Instit. Phys. Cap. XL.

being

1748. being numerous, and crouding the regimental infirmaries, (which were in the cottages near the line) they soon bred a malignant fever; from thence carried to the general hospital, then at *Ravenstein*. But there, the wards being spacious and well aired, tho' several of the sick were brought in with petechial spots, the contagion spread no farther.

On the 9th of *July* the camp broke up, and the troops went into cantonements. The head-quarters were at *Eyndhoven*, with the three battalions of guards; the rest of the Foot was quartered in the villages about; and the cavalry cantoned near *Bois-le-duc*.

At this time there were only about 1000 sick in all the hospitals, including such as had remained there from the last winter and preceding campaign; but in a few days after leaving the field, a distemper arose, which soon became as frequent as any that had hitherto afflicted the army: which may be 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 last 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 is deemed dry and healthful: but the appearance is deceitful; for, water is every where to be found

at

at two or three feet from the surface ; and in proportion to its distance from it, the inhabitants are more or less free from diseases. The country bordering upon the lower part of the *Maes*, is not only worse in this respect, but, by reason of the inundations from the smaller rivers, lies all winter under water, and continues damp throughout the summer. Another cause of the moisture and corruption of the air, were the inundations made about the fortified towns, since the commencement of the war ; which were particularly noxious, upon letting part of the water off 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* being made sensible of this, by the sickness that raged in *Breda* and the neighbouring villages, gave orders to let in the water again, and keep it penned up till winter.

The sickness was incomparably greater near *Breda* and *Bois-le-duc*, than at *Eyndhoven*, which lay at some leagues distance from the inundations, and was also removed from any other marshy grounds. The moisture, therefore, in the cantonements arose principally from the subterraneous water, which exhaled through the sand*. There were two villa-

* Vid. Ch. i. p. 2.

1748. ges near *Eyndhoven*, *Lind* and *Zelft*, the one ten and the other fourteen feet above the surface of the water, (an extraordinary height in that country) and it was observable how much better the soldiers had their health in both these places, than in any other of the cantonements.

At *Eyndhoven* two battalions of the guards were quartered in the town, and the third lay without, in the peasants houses; all within the compass of a mile: yet, what was remarkable, this, without the town, had always three times more sick in the *returns* than either of the other two; notwithstanding one of them had been very 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 all other points these corps were equal, as in diet, duty and exercise. A similar case occurred in the cantonement 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 remarkably sickly. And, as a farther proof how prejudicial it is to have the air confined by close plantations, in so moist a country, it was observable, that the *Dutch* camp at *Gilsen*, bordering on our cantonements, but ly-

* Vid. Ch. i. p. 4.

ing upon an open heath, preserved a good 1748.
share of health, while we were at the worst.
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 dry,
close and sultry. Near the inundations, the
nocturnal fogs were thick and fetid. The
heats abated in the beginning of *September*,
and the distempers in proportion; but till
the 20th of *October* the season was never
cold. At that time there were days of rain,
and high winds, and, towards the end of the
month, some hard frosts; then the weather
grew milder, and continued so, as long as the
troops remained in the country.

The first and worst appearance of the epi-
demic, was in the shape of an ardent fever.
The men were seized with a violent pain in
the head, and frequently with a *delirium*. If
sensible, they complained of grievous pains
of their back and loins, intense thirst, a burn-
ing heat, with great sickness and oppression
at the stomach; or of retchings and vomiting
of bile. Others had an evacuation of the
same by stool, with a *tenesmus* and pains in
the bowels. This fever generally remitted
from the beginning, if blood was let, and
timely evacuations made of the *primæ viæ*:
but if such precautions were neglected, the

1748. disease went on in a continued shape, and was dangerous. Such was the tendency to putrefaction, that some had spots and blotches and even mortifications, almost always fatal.

With these and such like symptoms, were most of the cases accompanied, during the first rage of the distemper, in the cantonments next the inundations: but, for such as lay farther from the water, and were only annoyed with the natural moisture of the country and the heat of the season, they had both fewer and milder fevers.

Thus, tho' the sickness was general, those who were near the marshes, suffered by far the most, both in 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 none ill; but after being five weeks in that situation, they returned, at one time, 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. *Rotbes's* and *Rich's* dragoons, who also lay near the inundation, were likewise extremely sickly. *Johnson's* regiment at *Nieuwland*, where the meadows had been floated all winter, and were but just drained, returned sometimes above half their number. And the *Scotch Fuzileers* at *Dintber*, tho'

tho' lying at some distance from the inundations, yet being quartered in a very low and moist village, have had above 300 ill at a time. 1748.

What was remarkable, a regiment of dragoons, cantoned at *Helvoirt*, (a village lying only half a league south-west of *Vucht*) was in a good measure exempted from the distrefs of their neighbours; having remitting and intermitting fevers of a better 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 being situated somewhat higher, upon an open heath.

Thus, the troops had been scarce a month in cantonement, when the *returns* of the whole were increased by two thousand; and they rose afterwards much higher. For, the sickness continued throughout *August*, and only abated with the heats, in the middle of *September*. Then, indeed, the fevers began to decrease in number, as well as violence; the remissions were also more free: so that insensibly, with the coolness of the weather, this raging fever dwindled into a regular intermittent, which entirely ceased upon the approach of winter. It was not a little curious to observe, how these agues declined proportionally with the withering and fall of the leaf. At this time less moisture ascends; and by the shedding of the leaves, the villa-

1748. ges come to be more open and perflated; and of course more dry and healthful.

Through all the cantonements, the officers were much less sickly than the common men: an advantage they owed to good beds, dry rooms, and better diet.

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, it was most frequent among the poorer sort, who lay on ground-floors, fared ill, and wanted medicine: for, without artificial evacuations, nature was either able to make no cures, or but slow and imperfect ones. This country had not known such distress for a number of years, as the two great causes had not concurred; I mean inundations, with a hot and close summer and autumn.

All this while the dysentery was little frequent; a circumstance that, considering the corruption of the humours, and their proneness to run off in a looseness, may require some notice. It may be remembered, that the flux was said to appear, when, after great heats, the perspiration was suddenly stopped, by wet cloaths, wet ground, or night-fogs and dews: but these, tho' common occurrences in a camp, are rare in quarters. Add, that the greatest rage of the dysentery is not so directly owing to the season, wet cloaths, or other accidents, as to the infection arising from

Ch. 8. Cantonements *in* DUTCH-BRABANT. 69

from the putrid excrements of many that happen to fall first ill of that distemper. Now, in the cantonements, the men were not only less exposed to wet cloaths, but when any were really taken ill from such a cause, they were so much dispersed, that the privies could not breed a contagion.

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

This was worse 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 three weeks, most of them were seized with this fever on board, or soon after they landed. It deserves notice, that the greatest number, and the most virulent cases, were in one of the ships, in which there happened to be two men with mortified limbs: which accident was not only the means of spreading the infection more at sea, but also in the wards they lay in, after coming ashore.

1749. The hospital, prepared at *Ipswich* for the reception of these sick, was obliged also to admit several more from the other transports, which, by stress of weather, put in on that coast: so that in all, there were about 400, and most of them ill of this malignant distemper. 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 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 fever abated sooner than could be expected. Thus the hospital broke up, after it had continued about three months in *England*.

Division of Diseases

OBSERVATIONS

On the DISEASES of the ARMY in

CAMP and GARRISON.

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, the causes, preservatives, or cures, since they must have too much interrupted the series of facts, that were proper to be presented at once, I reserved them for different parts of this work; and shall therefore proceed in this,

I. To divide these diseases into their several classes.

II. To enquire into their causes, as far as they depend upon the air, diet and other of the *non-naturals*.

III. To propose the 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.

C H A P. I.

*Of the Division of DISEASES most incident
to an ARMY.*

THE circumstances of soldiers, in time of war, are different from those of other people, in that they are more exposed to the injuries of the weather, and always crowded together, whether in camps, barracks or hospitals: wherefore the most general division of these distempers, may be into such as arise from the intemperature of the weather, and those from infection.

Military diseases, depending on the weather, are reduceable to two sorts, *viz.* to those of *summer*, and to those of *winter*; or, what is the same, to the diseases of the *camp*, and of *garrisons*. But whereas expositions to cold are unavoidable upon the first encampment, as also for some time before the army usually leaves the field, the winter-maladies, beginning about the end of autumn, will not entirely cease before the summer is well advanced: and on the other hand, as the heats of summer and damps of autumn dispose the body to sickness, the camp-distempers are never quite over with the campaign; but continue some time after the troops retire into winter-quarters. So that wherever we mention diseases as belonging to summer
or

or winter, to the camp or garrison, we are always to understand them 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 *bilious* or *putrid*: the inflammatory being the same with those of winter, and of the first encampment; and the bilious, no other than those of the summer, autumn, and part of what are carried from the field into garrison.

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

But the summer and autumnal diseases are of a quite different nature. In these seasons
the

the fibres are relaxed, the fluids are more rarified and disposed to putrefaction; in which state, if any stoppage should happen to perspiration, or to any of the excretions, designed to carry off the more volatile or putrid parts of the blood, a fever will be raised; which, according to the seat of the humours, their acrimony, or the vent given them, will appear in the shape of a remitting or intermitting fever, a *cholera*, or dysentery. *Hippocrates* ascribed distempers of this nature to a redundance of bile; and most other authors to a corruption of that humour: so that these summer and autumnal diseases have been both early and generally called *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 corrupted than usual: and this circumstance, tho' not the first cause, is the attendant of all the summer or 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* will 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 distempers appearing at this time, we shall find the antient maxim, that held, "the summer and autumn to be

* *Putrid* would be more proper, but I choose to retain the antient term *bilious*.

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 cause of putrid and contagious diseases.

Having laid down this general distinction between the summer and winter-distempers, it may be proper to make divisions of both seasons; in order to see their effects upon the health, according as either is more or less advanced.

When the cold weather begins, the men being thinly clad, are particularly subject to coughs, pleurifies, peripneumonies and other inflammatory disorders. 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 march into the field, (tho' no earlier than the first or middle of *May*) by that change, all the winter-distempers 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 which account, and because the bilious epidemics have yet made no progress, this commonly proves the healthfullest month.

* Saluberrimum ver est; proxime deinde ab hoc hyems; periculosior æstas; autumnus longe periculosissimus: CELS. (ex HIPP. Aphor.) Lib. II. Cap. I.

of the campaign. *July* is also favourable, if the preceding season has not been over hot, and the men have not lain in wet cloaths, nor on wet ground; accidents that always give rise to the dysentery. But, in temperate years and upon dry grounds, 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 unwholesome fogs. The dysentery declines with autumn; but the remitting fevers continue as long as the encampment, and never entirely 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 generally combined with the remitting fever, make the first diseases of the winter.

Tho' this be the common course, yet we may observe, that neither the *inflammatory* nor *bilious* distempers are so strictly confined to their seasons, but that, by various accidents, they may be found sometimes out of their place. In these matters, tho' there can be no precision, it is of use to know what ofteneft occurs. In the year 1746, when the troops encamped in the north, the *inflammatory* diseases, by reason of the coldness of the climate, continued throughout summer; and the *bilious* were either not seen, or were attended

attended with so much inflammation, that bleeding made much the greatest part of the cure *.

It is to be farther remarked, that as the two seasons run insensibly into one another, there will be, at the juncture, 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 high inflammation.

Lastly, it is to be observed, that the distempers of winter and summer differ greatly as to their cure. Thus, in all winter or inflammatory disorders, the principal intentions are to diminish the force of the blood, to thin it, and to relax the fibres; on which account, bleeding, attenuants and diaphoretics, are the chief remedies; whereas, in summer and autumn, while the humours are in a putrescent state, and the solids too much relaxed, such medicines will be mostly wanted, which clear the first passages, correct or expel the more corrupted parts of the fluids, and brace the fibres. Hence vomits, purges,

* Part I. ch. vi. p. 51.

stomachics,

stomachics, acids, and the Bark are then of such general use.

Thus far we may class the diseases depending upon the seasons or weather. It remains to consider such as proceed from contagion. The most fatal are the dysentery and hospital-fever; which, tho' sometimes arising from other causes, spread most from infection. Of the like contagious nature are the small-pox and measles; but these having never been general, I shall not rank them among the epidemics of an army.

The *lues venerea* and 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 afterwards in its proper place.

CHAP. II.

Of the CAUSES of DISEASES most incident to an ARMY.

IT appears from the first part, that the more frequent diseases of an army are either owing to the sensible changes in the air, and so have revolutions and periods like the seasons on which they so much depend; or, to such accidents as are almost unavoidable in

in a military life: Wherefore it will be proper to have a thorough knowledge of both these causes, in order to find out the best means for preventing their bad effects.

§. I.

Of the Diseases occasioned by Heat and Cold.

GREAT heats were 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 stopt by wet cloaths, wet beds, dews or fogs; and then some bilious or putrid distemper was the certain consequence. In the campaign 1743, tho' the weather continued long extremely hot, there was no general sickness till the men lay wet after the battle of *Dettingen*; and then the dysen-

* Soldiers in a camp suffer a great deal from heat, by being constantly exposed to the sun, either without any shade at all, or only sheltered 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, is 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.

tery immediately appeared *. Again, in the year 1747, the summer was likewise very 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, were the means of bringing on the same distemper †. And in the last campaign tho' the heats were great, they occasioned little sickness till the troops cantoned in the marshes; where a considerable degree of putrefaction and moisture being joined, ardent, remitting and intermitting fevers, and fluxes, that became so general, were only the remote 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 scorching heats; or when the troops marched, or were exercised in the heat of the day; or when imprudently the men 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 these errors produced inflammatory fevers, and in the end of it, or in the beginning of autumn, a remitting fever or dysentery.

But cold is oftener the more immediate cause of diseases, and is hurtful in two shapes; either when pure, or attended with

* Part I. ch. iii. p. 20.

† Part I. ch. viii. p. 62.
moisture:

moisture: of which the last is the worst. The diseases arising from cold weather, are all of the inflammatory kind; viz. coughs, pleurifies, peripneumonies, rheumatic pains, and the like; together with consumptions, which in the army are almost always owing to neglected coughs. The mildness of our winters, and the little duty our troops are put to 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 fire in *England*, to cold barracks, scanty fuel and sharp winters in the *Netherlands*; and that without any addition of cloaths. 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.

§. 2.

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 next winter, and in the campaign 1745. But soldiers are most lia-

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ble

ble to damps in their tents, where the ground can never be thoroughly dry, by reason of the constant exhalation, and is often very wet 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, tho' dry in appearance, may yet be moist by the transpiration of subterraneous water.

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 very 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 very salutary effect, by tempering the

* I made no experiments on the driness and moisture of different winds in the *Netherlands*, but trusted to the accounts of others. The learned professor MUSSCHENBROEK reckons all their northerly winds drying, but the east and north east the driest; and the west and south-west the moistest. *Vid. Institut. Physic. Cap. xlii.* * Compare Ld BACON's Nat. Hist. Cent. viii. Exp. 786.

heat,

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. But it will be proper to add, that tho' rains in summer may be generally useful to health, yet they will be of bad consequence when the men are obliged to march in them, or to lie upon the ground.

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 first taking the field.

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

The too great driness of the air has likewise been mentioned by authors, as the cause

* Vid. Part I. ch. i. p. 5.

† Vid. Ld. BACON's Nat. Hist. Cent. iv. Exp. 383. DIEMERBR de Pest. Lib. I. Cap. viii. and of this work, Part III. ch. iv. §. 4.

of epidemics; but, I imagine, without reason. For, whether in winter-quarters, or in camps, the soldiers are always exposed to too much moisture. And as for summer droughts, we are never thence to infer an over-dryness of the air; for as long as there are vegetables perspiring, the air will scarce ever want humidity sufficient for health: so that perhaps it is in sandy desarts only, we can learn what distempers are incident to mankind, breathing in too dry an atmosphere.

§. 3.

Of Diseases arising from putrid Air.

I Shall next consider how the air is corrupted by putrefaction, which of all other causes of sickness is the most fatal, and the least understood. This bad air, so destructive 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 ships upon embarkations, when men have little room, and are long on board.

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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*, and 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 inundations 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 not surprizing, that the distempers incident to such as breathe that air, should be of so putrid and malignant a nature: and that bilious fevers and fluxes should be so frequent, infectious and dangerous in such countries‡.

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

The second and third kinds of bad air proceed from the privies of a camp, and from rotten straw. Both these are always offensive; but while the bloody-flux prevails, as they contain the putrid excrements and *efflu-*

* Part I. ch. vii.

† Part I. ch. viii.

‡ Vid. Part I. ch. vii. and viii.

via of the sick, they are then particularly infectious and dangerous. At certain seasons, the most healthful have some disposition to the dysentery, which might go off of itself, were it not for these destructive steams, which work like a ferment and ripen the distemper.

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 corrupted by the perspirable matter of the body; which, as it is the most volatile part of the humours, is also the most putrescent. Hence it is, that in proportion to the nastiness of such places, to the number of dysenteries and of foul sores, but above all, of mortifications, a malignant fever is both frequent and mortal*.

§. 4.

Of Diseases arising from Errors in Diet.

IRregularities in diet are commonly, but unjustly, supposed to have the greatest share in producing military diseases. Was this the case, the changes in the weather and seasons would not so remarkably affect the health of soldiers; the soberest and most regular corps

* This subject, of diseases arising from putrid air, will be more fully treated of in Part III. ch. vi. §. 6.

would

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 diseases owing to any other causes, than what have been already assigned. All, therefore, that can be admitted on this article is, that there may be certain rules of diet, by the observation of which, soldiers may be made somewhat less liable to sickness; but there can be none proposed to make any considerable exemption, if the weather, ground and other circumstances do not concur in favouring their health*.

A soldier in time of war is, by the smallness of his pay, secured against excess of 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 bestow their pay upon strong liquors, and to squander away, in one day, what is but bare maintenance for a week. But, on the supposition that every man contributes 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 spent upon common food. For, as to the abuse of spi-

* All this article, upon diet, is only to be understood as relating to men in health, and not to the sick; who are always supposed to be under the strictest regulations of diet, depending on the hospital, and never left to themselves or their nurses.

rits and fruit, and drinking bad water, however generally they have been accused, I shall venture to affirm, that all these causes combined never occasioned the tenth part of any sickness in the army.

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 upon hard drinking, it is certain a far greater number 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 heat and cold, with moist and bad air, long marches, wet cloaths and scanty provisions. Now, to enable them to undergo these hardships, it is necessary they should drink something stronger than water, or even than small-beer; which is always new and bad in camps, and even there scarce within the purchase of a soldier's pay.

And as to fruit, another supposed cause of the camp-fevers and dysentery, it must be no less innocent; since these diseases being either of an inflammatory or putrid nature, cannot be owing to what is so much acid. Was the dysentery the effects of eating too much fruit, should we not find it a more common distemper among children? Nor, indeed, are the soldiers over fond of it; or, if they were, have

have they means to purchase it. It is scarce to be imagined, that when the daily pay, after stoppages, can but just purchase 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 farther remarked, that our worst flux began in the end of *June**, when there was no other fruit in the country but strawberries, which the soldiers never tasted; and that the same distemper entirely ceased before 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 such dysenteries as were epidemic in *London* in his time†: and *Degnerus*, another diligent observer, and the author of an excellent treatise on this distemper, expressly declares, that fruit had no share in producing the fatal dysentery that raged at *Nimeguen* sixteen years ago‡.

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

* Part I. ch. iii. p. 20.

† Vid. Op. § 4. Cap. iii.

‡ Vid. Hist. Dysent. Cap. ii. §. 30.

coincides with that season, in which fruit is in greatest plenty; and as fruit is laxative and apt to gripe, it was natural to assign no other cause for the dysentery, than eating of it immoderately; and the rather, as the true cause was so little obvious. 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 *diarrhæa* 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 somewhat of a different nature, as being mostly attended with a considerable inflammation. But, granting that fruit is capable of producing both fevers and fluxes, such as prevail in the army, yet, in some hundreds, that have been under my care for these distempers, as I never, upon the strictest enquiry, discovered this to be the cause, I must conclude, that it rarely takes place, and may be well omitted 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 abstain from fruit: for, tho' the acid may be good for correcting the disposition to putrefaction, yet the bowels are 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 either forbear fruit, or eat
of

of it moderately. Nor should the most healthful person deal freely in it, in close and marshy countries; because whatever is of so very cooling and relaxing a nature, must too much weaken the habit and check perspiration; by which means fruit, tho' really acid, may lay the foundation of some putrid disease.

Lastly, that many popular diseases are owing to bad water, has been an antient and prevailing opinion: and even *Hippocrates* resolves various disorders into that cause. But without entering into an enquiry about the justness of such notions, I shall only remark, that we are not to apply what is said of the water of those countries, where these authors 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, might concur with other causes in making the sickness so general in that country*. But at all other times the water was good, and particularly in the two seasons, during which the bloody-flux was most epidemic†.

To conclude, whoever will peruse our account of the several campaigns, will see such an uniformity in the rise and periods

* Vid. Part I. ch. i. and vii.

† *Viz.* In the camp at *Hanau* in the year 1743, and at *Maastricht* 1747. See Part I. ch. iii. and vii.

of diseases, so much connected with the state of the air, as to be convinced, that neither the abuse of spirits, nor of fruit, nor drinking bad water, could have any considerable share in producing them.

§. 5.

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, is obliged to make long marches, especially in hot or rainy weather: tho' the most frequent errors of men of that rank are on the side of rest. But the cavalry have a more uniform life, having little fatigue by marches; and a constant, but easy exercise, both in the field and 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.

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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 vinegar and water, and giving them clean linnen. So that officers judge right for the health of the men, as well as for the appearance, when they strictly require the cleanness of their persons and cloaths.

Under this head it will be proper to mention the itch, the most general distemper among soldiers. This spreads so easily by contact of the foul person, or of his cloaths, that one in the same tent, mess, or barrack, will quickly communicate it to the rest. Which circumstance, joined to the little attention men of that rank have to cleanliness, makes it a hard matter to keep it under, tho' the cure of each individual be easy.

CHAP.

CHAP. III.

*Of the general MEANS of preventing
DISEASES in an ARMY.*

TH O' most of the forementioned causes depend on the changes of the air, and other circumstances, which can scarce be avoided; yet, as all these are but relatively bad, and chiefly with regard to the state of the person, it follows, that such provisions may be made, as shall prepare the body to withstand most hardships incident to a military life. But as this maxim cannot hold strictly with a multitude, it can only be admitted so far, as a large body of men, losing but a few by sickness, may be said to be healthful. I need scarce add, that the preservatives from diseases are not to consist in medicines, or to depend upon any thing 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 made to obey.

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

* Ch. ii.

§. I.

How to prevent Diseases arising from Heat or Cold.

TO palliate the effects of intemperate heat, commanders have found it expedient so to order the marches, that the men should come to their ground before the heat of the day; and to give strict orders, that none of them sleep out of their tents; which, in fixed encampments, may be covered with boughs to shade them from the sun*. It is a rule of great importance to have the soldier early out, and exercised before the cool of the morning is over: 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 very hot weather, it has been found proper to shorten the centinel-duty, when the men must necessarily stand in the sun.

The preservatives from cold consist in cloaths, bedding and fuel. The experience we have had of the use of under-waistcoats, during the winter-campaign, in *Great Britain*†, should teach us to make the same pro-

* 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. ch. vi. p. 41.

vision for the whole army, in a future war. None of the foreign soldiers are without this necessary part of cloathing; 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 for the first winter*. A third and great article is, to provide strong shoes for the soldiers; as it is so well known how easily men catch cold by wet feet.

The second means of preservation mentioned, was bedding; by which is understood a blanket for every tent of the infantry: an order that has scarce taken place either in the *French* or our army, tho' practised elsewhere. We have observed of what advantage the cloaks were to the cavalry†; how much; therefore, blankets must be useful to preserve the health of the Foot, in the beginning and end of a campaign, is obvious. The only consideration to be made is, whether the expence and impediment of so much more baggage, will over-balance that advantage, or not.

The last article was fuel. Of this our soldiers might require a greater supply, as being

* Part I. ch. ii. p. 15.

† Vid. Part I. ch. iii. p. 19, 24.

of all 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 cooking their victuals, correcting the dampness of their barracks, and the rigour of a severe winter : trusting rather to their warmer cloaths and exercise, than to fire, for preventing diseases arising from cold. These two articles of cloaths and fuel are particularly recommended to the care of the officers by *Vegetius**, who collected the principal maxims of the ancient *Roman* discipline.

§. 2.

How to prevent Diseases arising from Moisture.

WHenever troops are to go into garrison, it is the business of the quarter-masters to examine every barrack, offered by the magistrates of the place, and to reject all ground-floors in houses, that either have been uninhabited, or have any signs of moisture. We have had an instance of the comparative driness of upper stories†, which are always preferable ; but particularly in the *Netherlands*, where the houses are without drains.

* 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.*

† Vid. Part I. ch. ii. p. 13.

But if dry habitations cannot be procured, the only resource against sickness from moisture, will be an increase of 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 always necessary when a camp is to remain above a night or two on the same ground.

It is of great importance to allow the soldiers plenty of straw, and to have it often renewed; a dry and fresh bedding being not only comfortable, but a preservative against diseases, and one reason of the better health the soldiers generally enjoy upon shifting ground; as the damp or rotten straw is then left behind. But in fixed camps, when new straw cannot always be procured, when it would be useful, 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.

It will also be necessary for the officers to air their tents daily; without which every thing will contract moisture. They are farther to be advised to have their bedding removed from the ground, to use a bedstead,

and never to lay the mattrafs on the grafs. Oil-cloaths spread on the ground of the tent, and kept dry, intercept much of the rifing vapour. Towards the end of the feafon, when the weather grows cold and damp, it will be found ufeful to burn fpirits in the evening, in order to warm and correct the air within the inner tent. But at no time are the officers to confine the air too much, even in cold weather, and efpecially when fick; taking it for a rule, that there is more danger in breathing in a moift atmosphere, loaded with their own *effluvia*, than in an open tent with a clofe *marquife*.

Soldiers are unavoidably expofed to rain on marches and out-duty; and upon getting wet cloaths, are extremely liable to ficknefs, unlefs they are allowed to cut down wood, to make fires in the rear of the camp: an indulgence which I have obferved to be of great benefit on thefe occafions.

Where the grounds are equally dry, the camps are always moft healthful on the banks of large rivers; becaufe in the hot feafon, fituations of this kind have a ftream of frefh air from the water, tending to carry off both the moift and putrid exhalations. And in cantonements, we are not only to feek villages removed from marfhy grounds, but fuch as are leaft choaked with plantations, and ftand higheft above the fubterraneous water. In

moist countries, towns are generally preferable to villages or single dwellings, for the reasons already given*.

§. 3.

How to prevent Diseases arising from putrid Air.

HAVING, in the preceding chapter, reckoned up all the sources of putrid air affecting an army, I shall now offer a few considerations upon the means of removing, or lessening each in particular.

First, with regard to the putrid air of marshes and other stagnating water, the same preservatives mentioned under the article of moist air, are in a great measure applicable here. If the military operations shall oblige an army to remain long on such grounds, the best expedient will be, to make frequent removes, and not continue fixed to one camp†; for, by shifting, the straw will be changed, the men will have more exercise, and the privies will be left behind; which, in camps are more than ordinarily

* Part I. ch. i. p. 4. and ch. viii. p. 46.

† Si autumnali æstivoq; 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.

noxious, on account of the greater frequency of the dysentery.

As for cantonements in marshy grounds, if the troops must remain there in the dangerous season, it will be better to float the fields entirely, than to leave them half dry: for, the shallower the water the more it will corrupt, and the evaporation will also be greater in proportion. The regiment at *Helvoirt*, which lay off the inundation about half a league only, was an instance how near troops may lie to marshes without any remarkable sickness*; at least if the wind should turn the vapours a different way. Commodore *Mitchel's* Squadron in *Zealand*, and the healthy cantonements at *Eyndhoven*, *Lind* and *Zelft*, in a sickly neighbourhood, afforded more instances of the same nature†. Nay, it has been observed at *Rome*, that the sphere of malignant vapours from the adjoining marshes, has extended only to those parts of the town which lay nearest them, occasioning bad fevers there, whilst the rest of the city was healthful‡. Thus, sometimes a little remove from the marshes may prevent a general sickness; but if that is inconsistent with the service, as happened in the campaign of 1747, when some battalions were sent into *Zealand*; and in the summer fol-

* Vid. Part I. ch. viii. p. 67.

† Vid. Part I. ch. vii. p. 58. ch. viii. p. 64.

‡ LANCIS. de nox. palud. Effluv. Lib. II. Epid. I. Cap. iii.

lowing, when our troops were cantoned among the inundations, we must be contented to palliate what cannot be avoided. But, as this is chiefly to be done by diet and exercise, we shall postpone the rules, till we come to treat of those articles.

Whenever the bloody-flux begins to spread, the best means of preservation are to leave the ground, with the privies, foul straw, and other filth of the camp behind : 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 over. 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, upon decamping, suddenly abated*. And in the year 1745, when this flux was milder than ever was known, there was not only the coolness of the season assigned for a cause, but also the frequent removes, during the time the army was most liable to the distemper†. But if any circumstance should make it improper to change the ground, when the dysentery begins to spread, there must be other methods taken to check its progress.

In order, therefore, to preserve a purity of air in the dysenteric season, let there be some

* Vid. Part I. ch. iii. p. 23.

† Vid. Part I. ch. v. p. 36.

slight penalty, but strictly inflicted, upon every man that shall ease himself any where about the camp, but on the privies. Farther, from the middle of *July*, or from 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 near full; and then they are to be well covered, and supplied by others. It may be also a proper caution, to order the pits to be made either in the front or rear, as the then stationary winds may best carry off their *effluvia* from the camp. Moreover, it will be necessary to change the straw frequently, as being not only apt to rot, but to retain the infectious steams of those who have fallen ill of the distemper. But if fresh straw cannot be procured, more care must be taken in airing the tents and the old straw, as before directed.

Lastly, when the disease begins to be frequent, the sick are never to be sent to one common hospital; at least, in such numbers as can vitiate the air, so as not only to communicate the infection to others, but to keep it up among themselves. This rule will be strongly enforced by attending to the facts mentioned in the account of the campaign in *Germany**, compared with what passed in the summer 1747†. Therefore, when the

* Vid. Part I. ch. iii. p. 22.

† Ib. ch. vii. p. 56.

dyfentery prevails, the regimental furgeons are to treat the flighter cafes in the camp itfelf; and the reft, as many as they can conveniently attend or accommodate, in the regimental hospitals; which are then, particularly, to be chofen fpaceous and airy. Barns, granaries and the like places, will allow the fteams to difperfe, without any danger from cold; fince the weather is, during that feafon, ufually warm. As for the general hofpital, let it receive fuch only as the regimental ones cannot conveniently contain, and the fick that cannot be moved with the army. Without this difperfon of the fick, the general hofpital, in bad feafons, may have the charge of fome thoufands; which cannot be well attended, but by a much greater number of hands, than has ever been allowed by the public. But were that objection removed, it would be ftill unadvifable to have but one common hofpital, on account of the great mortality that always enfues, upon croud- ing together fuch a number of men, ill of fo putrid a difeafe.

Having, in the account of almoft every campaign, mentioned the direful effects of the hofpital-fever, I need not urge the neceffity of uſing all precautions againſt it. Without entering upon a particular deſcription of its nature, which is reſerved for the third part, I ſhall at preſent only propoſe the means, whereby this diſeaſe may be either kept
from

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 right management of the air therein.

In treating of the bloody-flux, the most airy and spacious houses, that could be procured in the neighbourhood of the camp, were recommended, for the better recovery of the sick, and for preventing 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 it is air, more than heat, that 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* to *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 an hundred lay in it, with foul sores, fluxes and other putrid diseases, for three months together, (during the greatest part of which time the

* The putrid *effluvia* of the dysenteric *faeces*, are not only apt to propagate the common bloody-flux, but likewise to breed the malignant hospital-fever, with or without bloody stools.

weather was very hot) there was no appearance of this fever*. Wherefore we may lay it down as a rule, that the more fresh air we let into hospitals, the less danger there is of breeding the 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 the general hospital should be obliged to admit a great number at a time, (which they frequently must do, upon the motion of the army after a long encampment) it will be proper to have the sick dispersed into two or three villages, rather than kept in one; tho' a narrower compass might be more for the œconomy of the hospital, as well as more convenient, and for the easier attendance of the sick. The greatest danger being from foul air, it can never be compensated by diet or medicine: so that there appears the greater necessity of carrying at all times, as many of the sick along with their regiments, as can easily be transported in waggons.

It may be necessary to add the following distinction: in the first part of a campaign, when inflammatory distempers prevail, such as are taken ill are then to be left behind, as their cases admit least of motion, and at the same time are not infectious. But for those that fall ill from the end of summer

* Vid. Part I. ch. vii. p.

till the decline of autumn, as having diseases of a putrid kind, but which bear motion, and generally mend upon a change of air, they are therefore rather to be carried with their regiments and dispersed, than collected into one general hospital to propagate the infection.

As these regimental hospitals are of the greatest 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 are they to be maintained in the field only, but also in winter-quarters; as there will always be a great many more sick, on breaking up camp, than can be taken care of by the medical hands 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 war, one physician has sometimes had the charge of 700 at a time; in which case, the hospital might have the name of a physician, tho' little advantage from his attendance. But, suppose, that as many physicians were employed as were sufficient for the number of cases, and that every other part of the care was in proportion; yet the crouds, by corrupting the air, would render most of their labour ineffectual. This may easily be conceived from what has really happened;

pened; for, passing over the more than 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 make the practice so little successful, that by the most favourable computation, I have not been able to reckon less than one in ten that died, of all those who were admitted. Besides the better chance for good air, there is this farther advantage accruing from regimental hospitals, which is, that the several surgeons are best acquainted with the constitution and disposition of their patients, as well as with the whole 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 it to be more successful than that of one large and general hospital. To enable the surgeons still more to attend those of their own regiments, it would 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 well taken care of by two hands only: besides that, in sickly times, one or both may fall ill at once.

We shall next consider the general hospitals, which are of two kinds, *viz.* the flying
6 hospital,

hospital, attending the camp at some convenient distance; and the stationary hospital, which is fixed to one place. In the choice of both, it is to be earnestly recommended to those who shall have the inspection, to have the wards as large and airy as possible; remembering, that warmth is not wanting in summer, and that in winter it is chiefly to be procured by fires. It will also be better to have the general hospitals in towns than in villages, as the former will furnish larger wards, besides more of other conveniencies.

As to the disposition of hospitals, with regard to preserving the purity of air, the best rule is, to admit so few patients into each ward, that a person unacquainted with the danger of bad air, might imagine there was room to take in double or triple the number. It will also be found a good expedient, when the ceilings are low, to remove some part of them, and to open the garret story to the tiles. It is incredible, in how few days the air will be corrupted in thronged and close wards: and what makes it harder to remedy the evil, is the impossibility 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 always found those wards the most healthful, when, by broken windows

windows and other wants of repair, the air could not be excluded.

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

In winter-hospitals, the wards are to be warmed by chimneys, and never by stoves; for, tho' the latter may warm a large ward better,

* I have been favoured with the following paper of directions from the celebrated inventor, whom I consulted on this occasion.

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

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 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 to have a round hole in it, in the glass opposite to it, of a 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 entering in at the door: this is to be repeated as often in a day as shall be thought proper.

It

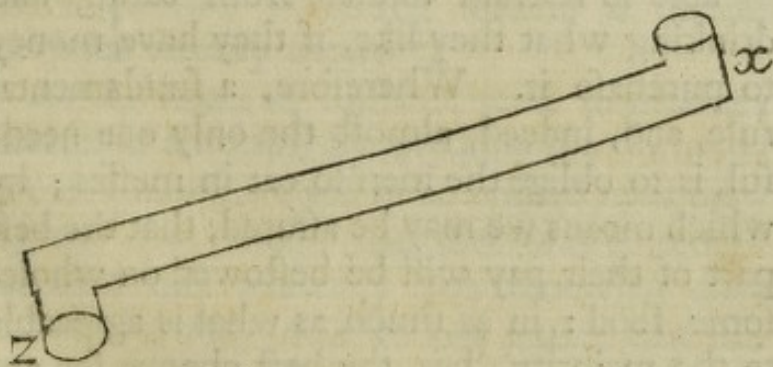
Ch. 3. DISEASES in an ARMY.

III

better, and at a less expence, yet by scarce making any draught of air, they will be apt to increase its putrid quality; whereas a fire, kept up in a chimney, acts like a constant ventilator.

If ventilators are used, other precautions will be 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 frankincense, the wood or berries of juniper; or some other

It will be requisite to have the holes both in the board fixed over the window, and in the side of the ventilator made round to receive the corresponding round orifices of the trunks; by which means the same trunk may serve for windows of different 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: viz. about five feet long, and twenty inches wide and deep, such as is described in my ventilator book, fig. 6.

resinous

resinous or antiseptic vegetable. The steams of vinegar are often recommended on these occasions, and probably will best answer the purpose; but being not so commodiously diffused as other things that burn, they have not hitherto been tried. The burning of sulphur or gunpowder is also mentioned by authors, as useful in such cases; and from their acid streams, they seem very likely to succeed.

§. 4.

How to prevent Diseases arising from improper Diet.

IT is to be observed, that no orders will be able to restrain soldiers from eating and drinking what they like, if they have money to purchase it. Wherefore, a fundamental rule, and, indeed, almost the only one needful, is to oblige the men to eat in messes; by which means we may be assured, that 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 answering that character. And it will be sufficient to trust 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

greatest impediment to messing, are the wives and children, which must often be maintained on the soldiers pay: in such circumstances, it is not improper food, but the want of it, that may endanger a soldier's health. The messing being established, there remains only to see that the men be well supplied with 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: in particular, vegetables, which, during the hot weather, ought to make a great part of the diet. Tho' the pay of a *British* soldier is better than that of other troops abroad, his œconomy is less; so that after paying his proportion in 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 shewn*.

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 was so ordered, that this tendency was somewhat corrected. It may deserve our notice that the *Romans* considered vinegar as one of the most indispensable provisions of an army†. Now

* Ch. 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.*

whether this was used by way of seasoning to their victuals, or mixed with water, and drank whilst they were hot or feverish, it must have had a good effect in correcting the two great putrescency of the blood, during the summer. Vinegar-whey, already known in the hospital, is an excellent cooler in inflammatory fevers, and was liked by the patients. But the surest way of making soldiers take an acid, would be by mixing either vinegar or spirit of vitriol* with such a proportion of spirits, as may be thought a proper quantity for each man, by way of preservative against diseases; especially when detachments are sent into *Zealand*, or the more marshy parts of *Brabant* or *Flanders*, during the sickly season.

Pork has sometimes been forbid in camps; being looked upon as unwholesome. *Sanc-torius* observes, it retards 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 believed also, that the meat is generally too little blooded, and thereby more disposed to corrupt, and to concur with other causes in breeding putrid diseases.

In establishing the messes, some regulations might be made with regard to an allowance of spirits, whether by stoppages on the pay

* Vid. Dr. HUXHAM's Ess. on Fev. Append.

or otherwise. This is already practised in the navy, and, probably, for the same reasons for which it might sometimes be proper here; since, in ships, men are also liable to distempers arising from moist and corrupted air.

As for the officers, whether in camp or in cantonements in a moist country, they are exposed, tho' in a lesser 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 all surfeits and indigestion*. Wine is necessary; but excess in every thing is, at this time, particularly dangerous. I shall conclude with that prudent rule of *Celsus*, for preserving against distempers arising from a moist and corrupted state of the air: *Tum vitare oportet fatigationem, cruditatem, frigus, calorem, libidinem*†.

§. 5.

How to prevent Diseases arising from errors in Exercise.

THE greatest fatigue a soldier undergoes, is in making long marches, especially in hot or rainy weather. When the service requires it, such hardships must be endured;

* Si qua intemperantia subest, tutior est in potione quam in esca. *CELSUS*, de med. Lib. I. Cap. ii.

† Lib. I. Cap. x.

but they will be attended with less sickness, if care is taken to supply good provisions, and plenty of dry straw. At other times, when dispatch is not required, short marches before the heat of the day, with proper halts, are so far from harrassing the troops, that nothing can be more conducive to preserve their health. Now in fixed camps, as there is always more sickness from inactivity than from fatigue, it will be altogether necessary to make proper regulations about the exercise at such times; and the rather, because our soldiers, left to themselves, are naturally indolent.

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 health, 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.

* *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.*

As to the second article, cutting boughs for shading the tents, making trenches round them for carrying off the water, airing the straw, cleaning their cloaths 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, in exposing them to wet cloaths, which, as has been fully set forth, is the most frequent cause of camp-diseases.

CHAP. IV.

*The SEASONS compared, with relation 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 were to remain 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 $\frac{1}{47}$ 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, and openness of the country, may be reckoned the earliest of all. And from all these instances there is reason to believe, that the proportion mentioned will generally hold, when the army is to take the field so soon.

But if the troops were to continue in quarters till the middle of *May*, the sickness of the first month would be considerably less; tho' perhaps not so much as might be expected. Thus, in the first campaign, our troops encamping on the 17th of *May*†, had

* *Vid.* Part I. ch. viii.

† Part I. ch. iii.

in the hospital, after the first month, about $\frac{1}{3}$ part of the whole number : a proportion, however, 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*, after a month's encampment, there was found in the hospitals about $\frac{1}{4}$ th part only : but as the weather was very mild, and other circumstances favourable, the proportion may perhaps be reduced in common years to $\frac{1}{5}$ th : so that, *cæteris paribus*, the number of the sick will be, after the first month, about $\frac{1}{4}$ 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 the weather is daily growing warmer. This healthy state continues throughout the summer*, unless by some extraordinary exposition to rain, the men get wet cloaths or wet beds ; whereupon, in proportion to the preceding heats, a greater or lesser degree of the dysentery will appear.

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

* That is, until the middle of *August*.

dyſentery prevails; and tho' its violence is over 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 froſt begins.

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 ſummer, it is impoſſible to foreſee how many may fall ſick from the beginning to the end of autumn. At the end of the campaign in *Germany*, the number of the men in hoſpitals was to the men in health as 3 to 13. 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, tho' half of the army were new men, we had but 1 in 17 ſick; and in the year following, which was remarkable for health, there was not above 1 in 26 ill: but in both years the troops returned into winter-quarters ſooner than uſual.

I have obſerved, that the laſt fortnight of a campaign, if protracted till the beginning of *November*, is attended with more
ſickneſs

sickness than the first two months of the encampment.

If, therefore, campaigns are to last six months, it imports much as to health, whether they begin early or late. For, tho' it may be thought safer for troops to delay encamping till the beginning of *May*, and to stay out till the end of *October*, yet experience shews it is better to go out a fortnight sooner, in order to return so much the earlier into winter-quarters.

We have already observed, that the remitting fever does not always terminate with the campaign, but continues, in quarters, till the frost begins; and that there are no other acute distempers, excepting such as are occasioned by violent colds*, from that period till the next encampment. But of chronic diseases, since the preceding 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 *returns* 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 take the field, next spring, without leaving above one man in 40 behind.

Winter-expeditions, tho' severe in appearance, are attended with little sickness, if the men have strong shoes, quarters, fuel and

* Part II. ch. i. p. 73. Ch. ii. p. 81.

provisions,

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. 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 over before the heat of the day.

Those who fall ill in the camp, (especially after the decline of summer) so as to be confined for some time to the hospital, are not to be relied upon for service that season; for, these being weakened by their sickness, and lying warm, while under cure, will probably relapse as soon as they return to the field. It might 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 will also tend greatly to prevent diseases, if the sickly or unseasoned corps are sent a fortnight earlier than the rest into winter-quarters, whenever that can be conveniently done.

Having mentioned the seasoning of troops, it may be proper to add the following caution, as a mistake here may so easily be made. 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

dered 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 diseases. I shall mention two instances. In the year preceding the war, our troops having encamped on *Lexden-beath*, near *Colchester*, and staid late out, returned sickly into quarters. Now it was observable, that those who recovered and went over 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 the first ill in the cantonements, and afterwards in the camp in *Germany*. So that these corps were never healthful 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 that of the 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 ensuing campaign were remarkably more sickly than any of the rest*. But whereas the first campaign in *Flanders* (tho' succeeding the sickly one in *Germany*)

* Part I. ch. vii. p. 57. Ch. viii. p. 61.

was

was healthful*, and as the next was still more so†, some may thence infer, that troops are only liable to suffer the first year, and being then seasoned, are afterwards to undergo the usual military fatigues unhurt. But, besides that the weather was extremely 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 almost lost all their sickly men there; so that those who took the field next year, were either old soldiers, who had never been ill, or recruits, *additional*s and new regiments which came fresh from *England*: these, therefore, holding well out, were rather a proof of what was 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 plight; consisting chiefly of fresh soldiers, or of those who were properly seasoned, by making a short campaign in moderate weather. But as a clear proof that the health and hardiness of troops is not to be measured by the time they have served, in the last two years of the war, the sick were, in proportion, as numerous as they had been in the two first. And what happened in the cantonements in *Dutch-Brabant*, during the last campaign, shews, that

* Part I. ch. iv. p. 33. † Ch. v. p. 37.

no seasoning can avail against the influence of the moist and corrupted air of marshes.

The whole amounts to this; considering all the hardships and expositions to sickness attending the easiest service, those troops will be best seasoned to undergo the difficulties of a second campaign, whose constitution has been least weakened by fatigues and bad weather in the first.

O B-

no seasoning can avail against the influence of the moist and corrupted air of marshes.

The whole amounts to this; considering all the hardships and exposures to the cold attending the earliest service, those troops will be best seasoned to undergo the difficulties of a second campaign, whose constitution has been least weakened by fatigue and bad weather in the first.

OBSERVATIONS

On the DISEASES of the ARMY in
CAMP and GARRISON.

PART III.

CHAP. I.

*Observations on the INFLAMMATORY FEVERS
in general.*

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

But whereas inflammatory diseases are every where common, and a subject so much handled by authors, I shall not enter into a particular account of any, but make a few

* Vid. Part II. ch. i.

remarks on such as most frequently occur in military hospitals.

Upon first taking the field, as well as during the winter, pleurifies and peripneumonies are the most common forms of the inflammatory fever; and next to them, fevers attended with rheumatic pains. The inflammation turns also upon the brain, liver, stomach, and other *viscera*. Universally, the fever taking its rise from a stoppage of perspiration, or whatever is the primary effect of cold, by first inflaming any of these parts, is afterwards kept up by that obstruction.

Sometimes we can perceive no part more affected than another, and only some general symptoms of inflammation. The distemper is then called simply an inflammatory fever; tho' if it continues beyond two or three days, it is probable that some one of the more *indolent* parts is at this time considerably obstructed. This sort is most common after the weather begins to be warm. But no inflammatory fever is ever seen single in the end of summer, or in autumn; at which time, 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, are attended with less fizy, and more putrescent blood. But towards the end of the campaign, when the weather

weather grows cold, the more violent 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 other men, who never had any. These are the more carefully to be distinguished from true agues, as they are to be treated chiefly by bleeding and other antiphlogistic remedies. If the Bark is given before the blood has lost its sîziness, the distemper will either be changed into a continued fever, or stopt for a while, to recur with worse symptoms.

The inflammatory fevers of an army differ from most others, in being more violent, and more frequently attended with a *diarrhœa*. The severities of the weather, to which a soldier is peculiarly exposed, his backwardness to complain of the first symptoms, his rough lying when he is taken ill, or his being carried to an hospital at some distance in a waggon, account sufficiently for the first. And it is either the want of a bed, or the lying cold, or drinking improper liquors, when first taken ill, that are the cause of the looseness.

As bleeding is the most indispensable remedy in the cure of all inflammatory diseases,

eases, it is chiefly by delaying this too long, or not repeating it, that colds end in dangerous fevers, rheumatisms or consumptions. As a soldier applies first to the surgeon of his regiment, on him it chiefly depends to prevent many disorders by timely bleeding. In general, young practitioners are apt to be too sparing in letting blood; and many lives are lost by deferring the operation for a few hours. But the surgeon may be assured, that a soldier will never complain of a cough, or pains with inflammatory symptoms, wherein bleeding is not proper. From the siness of the blood, and the continuance of the complaints, he is to judge of the necessity of repeating it, which, in case of a stitch or difficult breathing, is never to be delayed. A soldier, who has nothing to live on but his pay, in a foreign country, has not the means of breeding too much blood; and tho' strong, not being plethoric, bears repetitions better than the loss of a larger quantity at once. I have generally prescribed, in inflammatory cases, from twelve to fifteen ounces for the first bleeding, and somewhat less for all the rest. When it is necessary to exceed this quantity, it may be proper to follow *Celsus's* rule; in minding the colour of the blood whilst it flows, and when it is of a blackish cast (which it always is in difficult breathing and great inflammations) to let it run till it becomes

becomes more florid*. In all cases where plentiful bleeding is indicated, it is best to do it in bed, to prevent fainting; and we may observe, that a person will bear the loss of a much greater quantity of blood, if the stream is small, than by a large orifice; which some have thought necessary for making a more speedy revulsion.

Another prevention consists in an early sweat; for which one of the best medicines is the *haust diaphoret. pharmacop. pauper. Edinburg.*†. If the volatile *sal ammoniacum* is wanting, it may be supplied by the *sal c. c.* or by the spirit, if made without quick-lime. It is usual to give the *theriaca*, or some other warm medicine, for this purpose; but all such increase the fever, if they fail in bringing out the sweat: whereas the saline preparations operate without heat. The *theriaca* is rendered more sudorific and less narcotic, by adding ten grains of the *sal. c. c.* to a common dose, and promoting the sweat by a large draught of vinegar-whey. But as to the method of preventing fevers, it will fall

* De med. *Lib. II. cap. x.*

† 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.

Instead of this composition, we may give a spoonful of the plain *spir. mindereri* (diluted with a little water) every two hours till a sweat breaks out. Or, give at bed-time two scruples of the salt of hartshorn, saturated with about three spoonfuls of common vinegar in one draught.

more in the way of the regimental surgeons, than of the physicians attending the hospital, who rarely see the patient, till either the fever is quite formed, or so far advanced as not to be removed by sudorifics.

If, therefore, the *cold*, or feverish disorder has been of two or three days standing, it is to be treated by bleeding only, and such diaphoretics as are of a cooling, or at least little heating nature. Of this kind are the common nitrous medicines, and the saline draught of *Riverius*. But nothing perhaps is so efficacious in this way as the *Spiritus Mindereri**; the internal use of which was first mentioned by the learned professor *Boerhaave*†, and introduced into common practice at *Edinburgh*, by Dr. *John Clerk*, a celebrated physician of that city‡. Nitre has

* Pharmacop. Ed'nburgens.^a.

† Chem. vol. II. proc. cviii.

‡ 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 expressions, in an extract of a letter he favoured me with on that subject.

In relation to the Spiritus Mindereri, I never gave above half an ounce for a dose. When intended to promote a diuresis, I give that quantity twice a day mixed with an equal portion of Syr. de Alth. and find it seldom fail. But in a dropsy, I more commonly make use of the Julap. Diuretic. Pharmacop. Pauper. Edinb. I have sometimes added the Sal Succini, when I was sure of its being genuine; but that is rarely to be found. For that reason it is left out of the Pharmacop. Pauper. and the spirit put in its place, which has the same ratio to the salt, that the spirit of hartshorn has to its salt; tho' till then 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

has been given from about ten to fifteen grains every six hours. Larger doses generally disagree with the stomach, and even these will be sometimes too great. I have also followed the common practice in joining the *testacea* to the neutral salts, but without any particular attention at first to their effects; but having since discovered a strong septic quality in all those substances, in experiments out of the body, it was natural to conclude that they must exert a like power when taken by way of medicine*. And this perhaps would be oftener 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 also corrected by the *contrayerva* root,

quantity of Sal Cornu Cervi. to give it the alkaline cast, as in the Hault. Diaphoretic. Pharmacop. Pauper. When I design to provoke plentiful sweating, as in rheumatic diseases, I use the Julap. Diaphoretic. (Pharmacop. Pauper.) two spoonfuls every hour, or hour and an half, till the sweat breaks out; repeating it pro re nata, when the 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 C. C. in the space of four and twenty hours. In topical inflammations I give it the acid cast, by mixing with it an equal quantity of Acetum Scilliticum. I have often given it so in pleurifies and peripneumonies. I understand that some of my brethren use this form only. Of all neutrals, I take Sal Ammoniacum crudum to come nearest the Spirit. Minderer. I use sometimes the Bol. Diaphoret. Pharm. Pauper. but I do not find it near so efficacious as the julep.

* Append. Paper III. exp. xxiii.

and therefore with these additions they are less liable to exception*.

It will be necessary to distinguish these fevers into two stages; the first, in which the pulse is hard, and it is proper to bleed; and the second, when, the inflammatory symptoms still remaining, the pulse is too low for that evacuation. In this last state blisters are the chief remedy, and which, unless in a few cases, to be mentioned hereafter, are not to be used sooner. If blisters are made large, it is better to apply them gradually, than many at a time. It is usual to begin with the back, and, if necessary, to apply them next day to the legs or thighs, reserving the arms last, that the patient may be so much the longer conveniently moved. In great lowness attended with a *delirium*, sinapisms, applied to the soles of the feet, have frequently more efficacy than blisters in raising the pulse, and relieving the head. For this purpose I have used both the *formulæ* in the *Edinburgh* dispensatory.

It may be a proper caution in these hospitals, where the air is always to be suspected, to begin to provide early against its corruption. For which reason, as soon as the inflammation begins to abate, or the pulse to soften, I find it adviseable to give the diaphoretics in the following manner.

* See Append. Paper IV. exp. xxvii.

R aq.

R *aq. fontan. unc. iv. aq. alexeter. spir. unc. i.*
acet. destillat. unc. sem. julep. e camphor.
unc. ij. pulv. contrayerv. comp. scr. iv.
nitri puri scr. ij. syr. e cort. aurant. unc.
sem. misc.

Cap. sexta quaque hora cochl. iv.

The camphire seems to answer best when thus dissolved; and I have thought it most efficacious in such small doses, for abating inflammation and nervous symptoms; and also for promoting a gentle *diaphoresis*.

Towards the *crisis*, or in the declension of the fever, a little wine is to be added to the panado, or given in some other shape. In *lowness*, I have used some common cordial; but in great *sinkings*, I have added half a drachm of salt of hartshorn to six or eight ounces of that mixture, and given two or three spoonfuls for a dose.

Thirst is moderated by acidulating the barley-water or sage-tea with spirit of vitriol, or with lemon-juice; but by nothing so much, and so agreeably, as by allowing the patient some slices of an orange.

If the body has been costive before the disease, it is proper to open it by a laxative, after bleeding; but if not, it is sufficient to use clysters, when stools are wanted. After recovery, some lenient physic is generally requisite, for preventing a too hasty repletion incident to convalescents, upon indulging their

appetite: otherwise, purgatives seem at this time to be unnecessary.

Unless upon some particular indication, vomits are not to be given, and at any rate they are unsafe but in the beginning of the disease. This case may be excepted; when after a resolution of a peripneumony, the patient is ready to be suffocated by a tough defluxion; then, indeed, a gentle vomit is sometimes the best expectorant.

There is no caution more necessary to a young physician, than to abstain from all opiates throughout these fevers; however much the patients complain of pain or watchfulness. There may be some exceptions, but they being few and hard to define, it will be safest to make none besides the following one. If the fever is accompanied with a *diarrhœa*, not critical, the looseness is to be gradually checked by *diascordium**, after giving rhubarb, and endeavouring to turn the humours to the skin by the usual diaphoretics, (omitting the nitre) with the use of the white decoction for common drink.

Some low and nervous fevers are frequently attended with a looseness, which, tho' not immediately critical, can never be stopped without danger: but such rarely occur in the hospital, and do not properly belong to this class of diseases.

* See the *Formula*, Part III. ch. vi §. 4.

CHAP. II.

Observations on particular INFLAMMATIONS.

§. I.

Of the PHRENITIS.

THE *phrenitis*, or inflammation of the membranes 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* is one of the most general inflammatory symptoms, is confined to no season, and accedes indifferently to 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 waggons from the camp to an hospital; where the very noise, or light alone, is sufficient, with more delicate natures, to raise a phrensy.

An original *phrenitis* requires immediate, large and repeated bleedings; and the relief is thought to be the more certain, if the blood can be taken from the jugular. I have never advised cutting the temporal artery, finding such resource in applying six or seven leeches to the temples*. The benefit thence arising,

* Conf. MEAD Monita & precepta medica, Cap. i. sect. iii.

may

may be compared to the effects of a plentiful hæmorrhage by the nose. The rest of the cure consists in blisters, and other medicines common to all inflammatory fevers.

The cure of the symptomatic *phrenitis*, if the pulse can bear it, is also by opening a vein; but if this cannot be done by reason of *lowness*, it 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 last; because the barbers are careless, and in cutting the skin expose the patient to a violent strangury, or other spasms, which then are most to be avoided*. The common internal medicines are nitre and camphire; which last will not heat, and neither will disagree with the stomach, if after *Hoffman's* manner, we give them in very small, but repeated doses.

A *phrenitis* is often brought on, or increased, by a want of due perspiration and of warmth in the extremities. Wherefore, as soon as a soldier is brought into the hospital, with feverish symptoms, his hands and feet are to be washed with warm vinegar and water†; and through the whole course of the disease, care is to be taken to keep his

* Upon reading the first edition, Dr. WHYTT, professor of medicine in the university of *Edinburgh*, was so good as to remark upon this passage, that he had observed by shaving the head twelve or fifteen hours before the application of the blister, a strangury was generally prevented.

† Compare this with an observation in Part II. ch. ii. §. 5. feet

feet covered: by which means, some fevers will be sooner brought to a favourable issue, and the patient will be less subject to a *delirium*.

Abscesses have been found in the substance of the brain, both of such as have died of inflammatory and of nervous fevers, tho' no high phrenitic symptoms had appeared in the course of the disease. Whence we may infer, that the inflammation of the *meninges* is attended with more disorder of the senses and spasms, than an inflammation and supuration of the brain itself. But of this subject I shall treat more fully under another article*.

§. 2.

Of the OPHTHALMIA.

SOLDIERS are subject to an *ophthalmia* or inflammation of the eyes, not only from winter colds, but from their constant exposition to the sun and dust, during the campaign. The slighter cases may be cured without bleeding; but if any degree of fever is joined, or the inflammation is considerable, this evacuation is never to be omitted. The more violent inflammations are not to be cured without large bleedings, unless we can make a derivation from the part affected,

* Malignant fever, ch. vi. §. 4, 5, 6.

without

without draining the whole body. For this purpose, blisters are usefully applied behind the ears, especially if they lie on 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, tho' less generally practised, is bleeding by leeches; when two are applied to the lower part of the orbit, or near the external angle of the eye, and the wounds allowed to ooze for some hours, after they fall off. Wherefore in all greater inflammations, after bleeding at the arm or jugular, I have used this method, together with blisters and purging, if necessary. This practice is no less recommendable in inflammations of the eyes from external injuries; with this caution, however, that in great fluxions a large quantity of blood is to be first let, and immediately after, a revulsion is to be made by a brisk purge. But tho' these means are very efficacious in the common *ophthalmia*, they are never 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 eye; since the inflammation may either begin or be kept up by moats, or by hairs of the *cilia* falling in, or growing inwards, so as to cause a constant irritation,

The

The slighter inflammations, from the dust or sun, are removed by fomenting with warm milk and water, and anointing the eyes with the *unguentum tutiæ* at night. If the eyes are weak, or but little inflamed, they may be washed with brandy and water. But in bad cases, after the inflammation has yielded a little to evacuation, I found the *coagulum aluminosum* spread on lint and applied at bedtime, the best external remedy.

§. 3.

Of the ANGINA.

THE inflammatory quinsy* is most frequent and dangerous upon the first encampment. Its tendency to bring on a suffocation indicates the necessity of speedy and large bleedings, purging and blistering: but the method of using all these being so well explained by *Sydenham*, I shall only recommend the following remedy as one of the most efficacious. Let a piece of thick flannel be moistened with equal parts of any common oil and of spirit of hartshorn, and applied to the throat, to be renewed once in four or five hours†. By this means the neck, and sometimes the whole body, is put into a

* *Faucium strangulatio.*

† This medicine I had from Dr. YOUNG, physician at Edinburgh.

sweat, which, after bleeding, either carries off or lessens the inflammation. The *formula* is new, but not the intention; for the ancients applied warm oil with a sponge, and bags of warm salt*. And some later writers have recommended poultices made of the dung of animals†; which seems to be only a coarse and offensive way of using the volatiles.

I have observed little benefit arising from gargles, and have even imagined that such as were acid did more harm than good, by contracting the emunctories of the *saliva* and *mucus*, and thickening those humours. But a decoction of figs in milk and water seems to have a contrary effect, and especially if the spirit of *sal ammoniacum* is added, by which the *saliva* is made thinner, and the glands brought to secrete more freely: a circumstance always conducive to the cure.

§. 4.

Of the PLEURISY and PERIPNEUMONY.

I Come now to the pleurisy and peripneumony, the most frequent forms of our inflammatory fever. It is first to be remem-

* Ergo admovere spongiæ oportet; quæ melius in calidum oleum, quam in calidam aquam subinde demittuntur. Efficacissimumque est hic quoque, salem calidis cum saccellis superimponere. CELS. *Lib. IV. cap. iv.*

† ETMULLER. *Cap. de Angina.*

bered, that in these disorders the pain may be felt in any part of the chest, behind and before as well as in the sides; and sometimes so low down in the back as to be mistaken for nephritic: again, that as the *pleura*, not only lines the sides, but also invests the lungs, the *pericardium* and convex side of the diaphragm, the inflammation, wherever it begins, may be easily transmitted to any part of this membrane. But in whatever place the obstruction fixes, since the cure is so much the same, we may be the less anxious about knowing exactly where it lies.

The true pleurisy ought to be distinguished from the spurious; and also from some flatulent pains that resemble it. But as the true and the spurious agree in the viscosity of the blood, and also in the case they both receive from bleeding, and from blistering upon the part affected, an accurate distinction here will be the less necessary.

But a mistake about the flatulent kind may be of worse consequence. Hypochondrical and hysterical people are most subject to this sort; tho' such come rarely 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 excrements pent up in that part of the *colon* next the diaphragm. They generally strike from the breast to the back,

back, or from side to side, affect the breathing, and are sometimes attended with a short and frequent cough. But the fever, the hard pulse and sizziness of the blood, with other marks of a true pleurisy, are wanting. Bleeding does harm; but carminative laxatives, with warm applications to the part give ease. A blister is perhaps the only remedy common to both.

Tho' we are to reject the critical days, we must still observe, with the ancients, certain periods of the disease, distinguishable both by the symptoms and indications of cure. The sick are often brought into the hospital when the inflammation has spread over the lungs, and gone too far to yield to bleeding. Now however improper it would be at that time to commit the whole affair to nature, yet it is certain, that if the *sputum* appears, as described by *Hippocrates*, we are to consider it as a means of cure, and therefore not to divert it by bleeding or other evacuations.

With these cautions we are to proceed, letting blood freely for the first three or four days of the distemper; 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 and checking the expectoration.

With regard to the quantity and repetitions of bleeding, no precise rules can be given; *Sydenham* has specified forty ounces for

for the quantity men may, at a *medium*, lose in a pleurisy: but this would be much too small, were it not for blisters, which not only shorten the cure, but prevent the loss of a great deal of blood.

A simple pleurisy, or one attended with little inflammation of the lungs, may be cured with little bleeding. A large blister laid to the side affected is the remedy. This applied to any other place might stimulate and increase the disease; but, by acting directly upon the part, it resolves the obstruction, and thereby removes the fever.

This method of blistering the side is very antient, and was performed by *Sinapisms**. But at present the *flies* are only used, and the practice is become common in *Britain*†. Some difficulty remains about the time, whether it is best to use the epispastic in the beginning, or not till the pulse is softened by frequent bleeding. The experience I have had induces me to prefer a speedy application; for in treating great numbers in the hospitals abroad, I have seen no inconvenience in applying 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 plaister put directly to the side, and the person bled afterwards, be-

* CELS. *lib.* IV. *cap.* vi.

† MEAD *Monita et Præcepta Medica.*

ing satisfied if the vein was opened before the *flies* had time to stimulate. These lateral blisters have been usually made about the size of the palm of the hand with the fingers.

Tho' the symptoms should vanish upon blistering, it will be more secure to bleed again; unless a profuse sweat comes with the relief from pain, and makes all other remedies unnecessary. But if the lungs are at the same time much inflamed, the cure cannot be so speedy; for, tho' 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.

A peripneumony is naturally more dangerous than a pleurisy, and the more so, as the epispastic cannot operate so directly upon the lungs as upon the *pleura*. But, even in this case, blistering is most to be relied upon, after bleeding. The hardness of a soldier's bed in field-hospitals, makes it inconvenient to lay blisters to the back; but they have equal effects upon the sides; and when the men have lain softer, I have first blistered the back, and afterwards one or both the sides. Epispastics, 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 cautiously, if at all, used after the *sputum* appears.

In

In the first stage of the pleurisy or peripneumony, laxative clysters and the cooler diaphoretics are proper; but all cathartics and warm sudorifics do harm. The time for attempting a *diaphoresis*, is when the person finds ease by the blister: but whenever the *sputum* begins, the diaphoretics must either be omitted or joined to expectorants; whereof the chief is *oxymel* of squills, or in great heat or drought, some more pleasant acid. But in *lowness*, after repeated bleedings, I found the *sal. c. c.* joined to some oil, not only powerful in raising the pulse, but also in promoting expectoration when it flagged.

If, notwithstanding this discharge, the breast continues to labour, bleeding is still requisite: but in no case can there be more danger of going to extremes, whether in suffering the lungs to be overpowered by the omission of bleeding, or hazarding the suppression of the *sputum* by bleeding too freely. Dr. *Huxham* has delivered some of the best rules how to treat such cases*. But with regard to blisters, there need be no caution at such a juncture; as they are always seasonable, whether for raising the pulse, relieving the breast, or promoting expectoration.

If the obstruction is not soon removed, or the expectoration begun, there will be (as observed by the antients) signs of suppuration

* Vid. Dissert. on Pleurifies and Peripneumonies, subjoined to his Essay on Fevers.

about the seventh day ; but if the spitting has appeared early, it may continue long beyond that term, without any danger of suppuration. In the course of expectoration, a vomit sometimes will be useful in discharging the load of viscid phlegm. Sometimes opiates may be given, but with the greatest caution ; for, as long as the pulse is hard, the breathing difficult, or when watchfulness is owing to the fever, they do manifest harm. But when the fever is over, and sleep is only prevented by a thin defluxion on the lungs, opiates will both give rest and promote the spitting. If the phlegm is tough, or the patient costive, squills are then properly joined ; but if the body keeps open, and the head is affected by the paregoric, the *sal. c. c.* may be added as a corrector.

§. 5.

Of the HEPATITIS.

THE liver is a part not only liable to original inflammations, but also to suffer by translations of matter. I have found by many 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 outwards was let out, and the patient soon recovered.

Another

Another occurred, remarkable for the situation of the abscess, which was altogether on the left side of the *linea alba*. The incision was nevertheless made, and a great 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 such a quantity of matter.

A third case was singular for the flatness of the tumour, and an unusual difficulty in breathing; for, the man could not lie extended, but rested, for the most part, in a prone posture upon his knees and hands. He had, besides, frequent retchings to vomit, with a constant and uncommon pain and sickness at his stomach: within two days of 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, after plentiful bleeding, the best remedy was a large blister laid over the part affected.

§. 6.

*Of the INFLAMMATION of the STOMACH
and INTESTINES.*

THE same method has been successfully practised in inflammations of the stomach and intestines; nor have I known local blisters attended with bad consequences, how soon soever they were applied after bleeding. In particular, they are useful in the *ileus*; and seem to answer equally well in fixed pains of the bowels, whether from an inflammatory or a flatulent cause.

§. 7.

Of the RHEUMATISM.

THE antients comprehended under one *genus* both the gout and the distemper now called the rheumatism; giving the name of *arthritidis* to the affection of all the joints, whether the pain arose from inflammation, or from what the moderns understand by a goutish humour. If not all, but some particular joint suffered from either of the two causes, the distemper was denominated from the

the part: hence the terms *chiragra*, *podagra*, *ischias*, &c. all which they considered as *species* of the *arthritidis**. But whereas some arthritic pains were found to be of a different nature from others, they distinguished them according to the different humours they imagined to be the cause of the disease. Thus, one kind they supposed to depend on the blood, and, therefore, bleeding was recommended as the chief remedy; and in plethoric habits, even repetitions were insisted upon.

Altho' by making this distinction, the antients might 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 were often confounded, and consequently often improperly managed. Accordingly we find in later times, that the physicians came to consider all pains of the joints, that were not plainly goutish, as the effects of a rheum or a catarrh. Now this change of theory had a worse consequence; for, all catarrhus humours being supposed of a cold nature, bleeding was forbid, and the cure of an acute rheumatism was then attempted without opening a vein. *Botallus* was the first who opposed this practice, and

* Vid. HIPPOCR. lib. de Affect. Epit. GALEN. de Comp. Med. sec. loc. lib. x. ALEXAND. Trallian. lib. I. cap. I. AETII tetrab. III. serm. iv. cap. xxxiii.

distinguishing the inflammatory *species* of a catarrh from the rest, declares repeated bleeding to be necessary for curing it, and mentions two cases wherein his method succeeded*.

After him, *Ballonius* first used the term *rheumatismus*, to denominate this inflammatory *species*, which he also conceived to be different from either a gout or catarrh†. The same author has described the disease in a masterly way, and recommended repeated bleeding as the indispensable part of the cure; and this method has been since followed by the best practical writers; in particular by *Riverius* and *Sydenham*.

How frequently rheumatims occurred, especially in the beginning of a campaign, was seen in the general account‡; but we must add, that tho' the distemper appeared sometimes with all the violence mentioned by *Ballonius* and *Sydenham*, it was generally of a much milder kind. In a complete and obstinate rheumatism the joints are often considerably swelled and inflamed; but in our fevers with rheumatic pains, that was seldom the case; and therefore the cure was com-

* Lib. de Curat. per Sang. Miss. cap. xii.

† We meet with the word *ῥευματισμός* in *GALEN*; but so undeterminately used by that author, that it is uncertain whether by that he meant the disease we now call the *rheumatism*, or some other.

‡ Part I. ch. iii. and ch. iv.

pleted in a few days, by twice or thrice bleeding and promoting a *diaphoresis* by the cooler medicines, particularly by vinegar-whey. But if the rheumatism was attended with violent pains or swelling of the joints, sweating was improper, and the cure was only to be obtained by repeated and almost daily bleedings, till the patient was without fever and the pains were either entirely removed or rendered much easier. And in this course we may proceed the more boldly, as those that are subject to the distemper are generally in the vigour of life, and are either plethoric, or at least able to bear great evacuations. Add, that frequent bleedings weaken the body perhaps less in this disease than in any other.

If the pain and swelling of the joints remain after the fever is abated by repeated bleedings, apply three or four leeches to the part where the inflammation and tumour are the greatest; and let the blood ooze till it stops of itself. As the relief hereby obtained is sometimes considerable, and the evacuation but small, the repetitions need not be limited. *Ballonius* also mentions this practice; and I have had sufficient experience thereof to recommend it to others. But we are to expect no benefit from leeches in any pains of the joints, not attended with both inflammation and swelling.

In

In the true acute rheumatism internal medicines avail little. The best perhaps are the neutral salts, with very small doses of camphire, so as neither to heat or force a sweat. As to diet, it must be of the lowest kind, as Sydenham well advises.

Ballonius mentions paregorics, but without defining the kind, or the times most proper for giving them. Sydenham condemns them entirely, and, so far as I have observed, justly. Outward applications are also to be omitted, as long as any fever or inflammation remains. The spirituous and volatile liniments inflame, and the emolient fomentations, tho' they give ease for the time, do harm by relaxing, unless very sparingly used.

If the rheumatism is confined to one part of the body, attended with little or no fever, and recent, it may be cured by bleeding once or twice, and sweating with the following draughts.

R gum. guajac. (in vitell. ovi q. s. solut.)
gr. xv. aq. fontan. unc. i. aq. alexeter.
spir. dr. ij. spir. Minderer. unc. sem. syr.
e cort. aurant. dr. i. misc.

F. haust. b. s. sumend. et die crastino, mane,
vel sæpius repetend.

If the patient does not sweat easily, the dissolved gum may be given as a laxative in

a proper vehicle, and continued daily till the pain goes off*.

But the chronic rheumatism is one of the most obstinate diseases of the hospital; being either the remains of a rheumatic fever, or the continuation of pains that proceed at first from lesser but neglected colds. In complaints of this kind, if the blood is not found fizy, we may presume the soldier either pretends indisposition, or that the pains are of another nature†. *Sydenham* has also described this *species*, wherein, tho' there is no fever, he recommends bleeding; and which, of all remedies, I observed to be the most efficacious. The patient is therefore to lose about eight ounces of blood, once in eight or ten days, as long as it is fizy, or his complaints remain: and between whiles, let him be purged with the gum *guajacum*, in a larger dose than in the *formula* above.

On the intermediate days, let him take, twice or thrice in the four and twenty hours, fifty or sixty drops of the spirit of hartshorn in a draught of water. When I began this method, the spirit happened to be made with quick-lime; but it was not therefore the less

* In military hospitals it is always more convenient to give laxatives than sudorifics, if the former will at all answer, because of the danger of catching cold after sweating.

† In our hospitals the rheumatic pains were almost always attended with fizy blood. This mark however of a rheumatism is not constant, having since seen persons with the same complaints, under no temptation to deceive, without any alteration in their blood.

successful*. If the joints are swelled and inflamed, leeches are to be used, as before; but if there is no inflammation, the aking parts are to be rubbed with flannel, and anointed with the *linimentum volatile*, or *linimentum saponaceum*, according as the skin is too much hardened, or relaxed by the continued use of the one or the other. After a person has continued some time in this course, his recovery will be quickened by the use of the cold-bath, or the Bark†; and to those who can afford it, riding is specific.

By this method I have known many cured; but I must likewise acknowledge, that several slight cases, in appearance, have withstood these and all other methods 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 sooner yield, if once or twice a week we give a large

* I imagine it might be still a better method, to keep the body constantly open with a solution of the *guajacum*, in smaller doses, repeated daily; but without omitting the volatile salt, which I consider as one of the best medicines in this distemper.

† Some physicians have, of late, recommended the Bark in acute rheumatisms (after plentiful bleeding) as soon as a sediment appears in the water; tho' some degree of fever should remain, and the pains be still considerable. But having had no experience myself of giving it so early, I cannot recommend the practice to others.

I have never had recourse to issues or setons, for the cure of the chronic rheumatism, being inconsistent with the life of a soldier out of the hospital.

dose

dose of *Calomel* over night, and purge it off next morning*.

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, tho' the common men, and especially at their time of life, seldom or never feel the true gout; yet, by irregularities or diseases, the humours may tend that way, without producing any regular fit. And I imagine, that those pains may be of this kind that sometimes are felt after obstinate and irregular intermittents, which *Sydenham* believes to be owing to the Bark, tho' they were taken notice of long before the use of that medicine†.

As the blood may be fizy in the vague arthritic pains, as well as in the rheumatic, it will sometimes be hard to distinguish them; and therefore, as a new diagnostic, I shall insert another observation communicated to me by the learned Dr. Clerk.

The Arthritis vaga, or flying gout (erroneously called a scorbutic rheumatism) is often

* In obstinate cases, without fever, RIVIERIUS recommends repeated large doses of calomel joined to a purgative. *Prax. lib. xvi. cap. 3. & Observat. cent. iii. obs. 41.* 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 in the former chiefly that the mercurials have been found so efficacious.

† Vid. BALLON. de Rheumatismo.

distin-

distinguished by the urine of the person, in which float certain filaments, not so transparent as the urine itself, but when taken out of it, appear as pellucid as crystal, rope to a great length, and when dried turn to a white calx. This I take to be the *materia morbifica* of the gout, gravel, goutish, sciatic and all true arthritic pains, distinct from the rheumatism. I suppose it to be that humour the ancients called *pituïta vitrea*, not perceivable in blood when let, but conspicuous in the urine of such as labour under these diseases. The moderns (at least all that I have looked into, except those who copy the ancients) make no mention of this *pituïta*. Soap is the best dissolvent of it that I have tried, and I have given it from half an ounce to an ounce a day, for some months (when requisite), in the sciatic and other arthritic pains.

The sciatic of our hospitals is almost always of the rheumatic kind, and therefore, if recent, yields to bleeding, and blistering upon the part. But if the distemper is of a long standing, or the cause goutish, 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 long pining, died at last of the agony. At that time I had not thought of any dissolvent.

CHAP III.

*Observations on COUGHS, and the PHTHISIS
PULMONALIS.*

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 are succeeded by tubercles, which making the cough worse, at last tear and ulcerate the lungs. In all the bodies which I dissected, of those who died of the *phthisis pulmonalis*, I found the lungs full of both tubercles and ulcers.

We cannot, therefore, be too 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 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, or by any common sweet oil. But the oils are made more efficacious by the addition of a volatile alkaline salt, in this manner:

R *ol.*

R *ol. olivar. unc. ij. aq. fontan. unc. vi.*
syrup. simp. unc. i. spir. c. c. gutt. L—C.
misc.

Cap. subinde cochl. ij.

When the obstruction is of an older date, oily medicines are not only useless, but relax the stomach, pall the appetite, and increase the disorder. A continuance of them requires emetics more than the disease itself.

In the 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 hot and restless nights, I have trusted most to small but repeated bleedings*, and to pills made up of soap, squills and gum ammoniac*.

I have found these small bleedings not only beneficial in old coughs, threatening consumptions, but also after a purulent spitting and hectic symptoms had appeared. The quantity of blood drawn was from four to seven or eight ounces, once in eight or ten days; and sometimes a vein was opened after shorter intervals. It is observable, that the patients never find themselves so much relieved on the first, as on the second or third night after venisection. The blood was constantly fizy; but if ever it had been seen in a resolved state, to have insisted then upon taking away

* Conf. MEAD Mon. et Præc. Med. cap. I. sect. x.

† Viz. Pil. Scillit. Pharm. Edinburgens.

more, had been altogether improper. Nor, would I recommend this method for common practice, without making great allowance for the strength of our men, and suiting the quantity of blood to be let to the condition of weaker patients.

But, I can freely recommend, from repeated trials, the use of setons or issues, made in the side upon the part that is most affected. In particular, they were useful to such men, as being frightened at the loss of so much blood, had it not so often taken away as was judged necessary.

In thirst, heat and other symptoms, the signs of a putrid state of the humours, the ptisan is to be acidulated with the spirit of vitriol; and the aliments are to be chosen of the acedent kind. A mixture of equal parts of barley-water and sweet milk, seasoned with sugar and nutmeg, makes a proper and an agreeable part of diet. Butter-milk is here most specific. In costiveness, let the patient drink a decoction of bran with raisins and liquorice.

I have found nothing diminish the hectic fits so much as small bleedings; but it will be proper to add the saline draughts, and a cooling diet. Colliquative sweats were most safely checked by lime-water, whereof the patient drank about a pint a day, softened with a little new milk.

M

In

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 extremely sensible to irritation. And it is this last kind which, perhaps, is the most painful and teasing to the patient. The same medicines are not proper for both. The first sort is to be treated with the balsamics, if the ulcer is open and the matter can be expectorated. For this purpose I have used the balsam of *Peru*, but without finding it more efficacious than the *copaiva*. Of this last I have commonly given about ten drops, twice a day, in a bolus of conserve of roses; or, if that form was less agreeable, in the following mixture.

℞ balsam. *copaiv.* (in vitell ovi q. s. solut.)
 dr. i. aq. fontan. unc. iv. aq. cinnamom.
 spir. unc. i. syrup. e cortic. aurant. una.
 sem. misc.
 Add. pro r. n. elix. paregoric. dr. ij.
 Cap. bis die cochl. ij.

The last ingredient is added, occasionally, to keep the balsam from purging.

The other kind of cough can only be palliated by incrassants; and for that purpose I have constantly used the conserve of roses, and opium. The first is altogether safe, and otherwise

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 heat, to bind the body, and to obstruct expectoration. However, as these bad qualities are in a great 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 bedtime; and have increased the dose of each ingredient when there seemed to be occasion for it.

I have never ventured to give the Bark in any stage of the consumption, unless in the convalescent state, when the lungs seemed to be free from obstruction. Then, I have sometimes given small doses of the *tinctura corticis* with the *elixir vitrioli*, in order to brace the fibres, and to restore the appetite.

Riding and asses milk, the two great resources, are wanting in military hospitals: what is still worse, the air of such places, or of full barracks, is very contrary to the cure. Hence it happens, that tho' these means may often succeed with men better accommodated, they will generally be frustrated by the foul steams they breathe there: and tho' a soldier may chance to escape their bad effect

* Communicated by Dr. CLERK.

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 great benefit arise from small and frequently repeated bleeding in the cure of wounds, when matter has been absorbed, and a hectic fever produced thereby. This generally happens from sparing incisions, or not being able to make them in the cure of gun-shot wounds.

CHAP. IV.

Observations on the fevers called BILIOUS, or the REMITTING and INTERMITTING FEVERS of the ARMY.

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

The bilious diseases 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 moisture of the ground and climate. Tho' of different forms, they

* Why so called, vid. Part II. ch. i p. 74.

are all of a like nature, and may be properly reduced to two heads, *viz.* fevers and fluxes.

Beginning with the bilious fevers, I shall first describe that which is frequent in every camp; secondly, what seemed more peculiar to the marshes; in the third place, I shall enquire into the nature and causes of both; I shall then proceed to compare these fevers with those of other places in the like circumstances; I shall next propose the method of cure, both for the fevers of the camp, and for such as occur in the marshy countries: and lastly, mention such remedies, as I found most successful in the cure of obstructions consequent on these distempers.

§. 1.

Of the Symptoms of the Bilious Fever 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, with pains in the head, and they have all a tendency to remit. This change, just discernible after the solstice, becomes remarkable before the end of summer, or in the beginning of autumn.

The 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 akes violently; the person 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: on the second morning, it remits as before. These periods go on daily, till the fever changes insensibly, either into a continued or into an intermitting shape. Sometimes loose stools carry off the fit, and supply the place of sweats.

Altho' the fever most frequently appears in the form of a quotidian, yet sometimes it is to be seen in a tertian shape. But tho' the distemper resembles an ague in many particulars, yet it is a rare thing in the camp to meet with a real one, unless the person has been ill of it before he took the field.

The remissions usually appear from the beginning, and especially if the patient has
been

been plentifully blooded : but sometimes there are no remissions for the last two or three days. Hamorrhages of the nose happen frequently in the height of the paroxysm, and always bring on the remission sooner and make it fuller. Vomiting or purging have like effects. But I remember of no natural evacuations making a complete cure, unless when a *cholera morbus* supervened.

The fits are seldom preceded by shiverings, or any sense of cold after the first attack ; the pulse is always full and quick during the paroxysms, and in the remissions 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, therefore, shews some signs of inflammation, even in the beginning of the epidemic ; but towards the end of the campaign it acquires an inflammatory crust : for, by that time, to the other symptoms are joined either stitches, rheumatic pains, or a cough from colds.

Whilst the weather continues warm, the bilious symptoms are most frequent ; but as winter approaches, the inflammatory prevail.

The urine is high coloured and crude, till the fever is brought to intermit. What is voided by vomit or stool is generally of a bilious or 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.

Tho' all do not vomit, yet every one feels a disorder at the stomach, and especially during the hot weather.

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

Some grow yellow, as in the jaundice. This colour was found more frequent during the first campaign than afterwards: it was an unfavourable, but not a mortal sign. The body of one dying with this symptom was opened, but no *calculus* nor any kind of obstruction was discovered in the gall-bladder, or biliary ducts.

The infantry was more subject to the fever than the cavalry, and these last more than the officers: which was owing to the difference of cloaths and accommodation*.

There were no critical days, nor any certain duration of the distemper, which was longer or shorter, according to the method of cure. The most favourable and common determination, was into an intermittent, if proper means were used. But this fever is often fatal to an army, when so many are seized at once as cannot be properly attended; or by changing into a continued or malignant

* Vid. Part I, ch. iii. p. 24.

shape, either by neglect at first, or by crouding together too many that happen to fall ill of it into the same hospital.

This bilious or remitting fever attended every campaign, and was most frequent and violent after the hot summers of the years 1743 and 1747. But in the campaigns 1744 and 1745, the seasons being temperate, the fevers were both fewer and milder.

§. 2.

Of the Symptoms of the Bilious Fever in low and marshy Countries.

THIS *species* of the bilious 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 tho' all moist countries are subject to intermittents, yet if the moisture is pure, and the summers are not close and hot, these fevers will mostly appear in a regular tertian shape, and be easily cured. But if the moisture arises from long stagnating water, in which plants, fishes and insects die and rot, then the damps being of

* Part I. ch. i. p. 6, 7.

† Part I. ch. vii. p. 57. Ch. viii. p. 65.

a putrid nature, not only occasion more frequent, but more dangerous fevers, which oftner appear in the form of quotidians, or double tertians, than that of single ones. These are not only apt to begin in a continued shape, but after intermitting for some days, to change again into *continuals* of a putrid and malignant nature. It is remarkable how much these fevers 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 worst kind of fevers were observed to prevail in the country bordering upon the inundations in *Dutch-Brabant**; the next were those of *Zealand*†; of the third degree, were such as appeared in the lines of *Bergen-op-Zoom*‡; and the mildest sort, comparatively, were those that were most frequent in the cantonements round *Eyndhoven*§, in villages rendered moist by plantations and under-ground-water, but that 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 about a fortnight or three weeks in the cantonements, whilst the days were sul-

* Page 63. † p. 57. ‡ p. 59. § p. 63.

try, but the nights cool and foggy*, several of the men, (of those regiments that lay nearest the inundations) were seized at once with a burning heat and violent head-ach: some feeling a short and slight chilliness before, others mentioning no preceding disorder. They complained, besides, of intense thirst, aking 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, sometimes attended with a vomiting of green or yellow bile of an offensive smell. The pulse was upon the first attack generally depressed, but rose upon bleeding. There were several instances of the head being so suddenly and violently affected, that without any previous complaint, the men run 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*.

Some time after, Dr. *Stedman*, then surgeon to the *Greys*, acquainted me, “ that,
“ two of their men, who were the first taken
“ ill, were at once seized with violent symp-
“ toms of an ardent fever, and tho’ they
“ were speedily and plentifully blooded, yet,
“ in an hour thereafter, both were in a high
“ *delirium*, which continued for some hours,
“ and went off with a profuse sweat, under
“ which all the other symptoms either abated

* Part I. ch. viii. p. 65. and seq.

“ or

“ or vanished. That, next day, about the
“ same hour, the paroxysm recurred, and
“ in six or seven hours run the same course.
“ In this shape the fever appeared with many
“ of that regiment, but others had not the
“ paroxysms so distinct, as the hot fits were
“ long and followed by imperfect sweats
“ affording little relief. Sometimes the fe-
“ ver had daily intermissions, but generally
“ it only remitted; and the remissions were
“ often so imperceptible, that the disease ap-
“ peared almost in a continued form. That,
“ the nearer it approached to this last state,
“ it was the more intractable; but when the
“ paroxysms were distinct, with an intermis-
“ sion of some hours between them, the pa-
“ tients, for the most part, did well, how-
“ ever great the *delirium* was during the hot
“ fits. That, a few returns of those pa-
“ roxysms reduced their strongest men to
“ so low a condition as not to be able to
“ rise. That, some became at once deliri-
“ ous without any previous complaint, and
“ would have thrown themselves out of
“ windows, or into the water, if not pre-
“ vented: that, the phrenzy continued for
“ some hours, after which the patients fall-
“ ing into a profound sleep awaked quite sen-
“ sible, but with an intolerable head-ach.
“ That others, with whom the fever ap-
“ peared in a continued or remitting form,
“ had critical sweats about the ninth day;
“ after

“ after which it became a regular intermit-
“ tent. A few had a *crisis* by stool or urine,
“ and there were some who were ill about
“ three weeks, without any sensible remis-
“ sion; after which the fever ended with
“ some quotidian paroxysms: these men,
“ during their illness, had gentle sweats, or
“ rather a continual moisture over their body.
“ That many, upon being first taken ill, had
“ bilious vomitings; and several voided round
“ worms both ways. That, the profuse
“ sweats had always a putrid smell; and the
“ discharge from the blisters was so offen-
“ sive, that the nurses declined dressing them.
“ What was most remarkable, a few of
“ those who died were observed to have a
“ regular pulse, tho’ very near their end.
“ That all those who died, had for some
“ days before, a cadaverous smell, and im-
“ mediately after death, 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 near their
“ quarters, and that a great number of them
“ died.”

This account of the beginning of the epi-
demic being so full and accurate, I need only
add, that it agreed with the observations of
all the surgeons of the other regiments in the
like situation; allowing for some variation,
according to the different circumstances of
those

those corps. Thus Mr. *Lauder*, surgeon to the *Iniskilling* regiment, then lord *Rothes's*, informed me, " that most of their men were
 " 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, the men were obliged to set out about four in the morning,
 " in order to get back before the heat of the
 " day. That, at that early hour, the meadows and marshes on each side of the
 " road were constantly covered with a thick
 " fog of an offensive smell, which he looked
 " upon as the chief cause of the sickness.
 " For, tho' the party returned generally before noon, Mr. *Lauder* always found several among them already in a fever, and
 " some of them actually delirious. Nay,
 " that a few, on their way home, were so
 " suddenly taken with a phrenzy, as to throw
 " themselves from off 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 head-ach, thirst
 " and burning heat; and that all of them,
 " attempting to sit up, were ready to faint
 " away, with a giddiness, sickness at sto-

* Vid. Part I. ch. viii. p. 66.

“ mach, and retchings to vomit. These
“ fevers were for some days of a continued
“ form, or at most attended with slight re-
“ missions; after which, they either remit-
“ ted more plainly, or thoroughly intermit-
“ ted. That at first the pulse was small and
“ depressed (tho’ the patient was then deli-
“ rious) but that it always rose upon bleed-
“ ing.” The same gentleman has lately told
me*, that two of those men, who were taken
so suddenly with a phrenzy, in their return
from foraging, tho’ they recovered of their
fever, have been ever since epileptic; and
that all the rest who had been ill, and are
yet in the regiment, are still liable to returns
of an ague.

The condition of the Foot was somewhat
different; for, few of them being cantoned
near the inundations, their fevers, tho’ fre-
quent, were generally of a milder nature: yet
some of those corps had the sickness also in
a high degree, from the moist and corrupted
air of their quarters. The village of *Din-
ther*† lay very low, was surrounded with
ditches, and thick plantations. Mr. *Tough*,
surgeon to the battalion there, observed,
“ that the meadows were covered every
“ evening with a fog, which continued till
“ next morning after sun-rising, having
“ always the offensive smell of a foul ditch

* *Viz.* about three years after this sickness.

† *Vid.* Part I. ch. viii. p. 66.

“ newly

“ newly drained. That, the men were com-
 “ monly taken ill in the night-time*, with
 “ a shuddering or sense of cold, which was
 “ soon followed by a violent head-ach, in-
 “ tense heat and other feverish symptoms.
 “ At which time the pulse was so small and
 “ depressed, that if a vein was opened, the
 “ blood at first would scarce run; but that
 “ after some evacuation, it flowed briskly,
 “ and the pulse rose upon bleeding. A pro-
 “ fuse sweat succeeded the heat, and with
 “ that a remission or intermission of the fever.
 “ That, the paroxysms returned every even-
 “ ing, and if care was not taken to stop the
 “ fever soon, it was apt to change into a con-
 “ tinued form, with malignant symptoms.
 “ In three cases he observed petechial spots;
 “ and in a fourth, a mortification under the
 “ left breast; which yet was cured by the
 “ Bark. And that there was one instance
 “ of a man, who being suddenly seized with
 “ the usual head-ach, and not immediately
 “ blooded, 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 the fevers an-
 swered the description of the *κᾶυσος*, or *ar-*
dent fever of the antients, which *Hippocrates*

* 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 advanta-
 ges, lay in barns and other damp places, without any covering.

never ranks with the inflammatory diseases of the winter and spring, but always with the bilious epidemics of summer and autumn*: tho' later writers have applied this term to all fevers attended with great inflammation.

But it was observable, that even in the very worst tracts of those countries, as soon as the weather cooled in the decline of autumn, all the fevers began to assume a milder nature; and in the end of the season, differed little from the common intermittents of other places.

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

When the sickness was at the worst, many voided round worms; which were never the cause of the fevers, but, as was observed before, often concurred with other circumstances to render the cure more difficult.

At the height of the epidemic it appeared, that both intermittents and remittents,

* Aphor. lib. III.

The ardent fever of the antients was either continued or remitting; of which last GORRÆUS gives the following description. *Est hæc tertianæ febri dysergicæ, ut qui ab iisdem causis, eodem anni tempore & iisdem corporibus provenit, a quibus & tertianæ febres excitari solent. In tertiana intermittente primum rigor, deinde ἀτυξία est: verum ardentis exacerbationes nullo cum rigore fiunt, nec unquam integre solvuntur, sed modice tantum remittuntur.* Vid. Definit. in voce Κᾰσος.

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

But in general, the mortality was not in proportion to the number of the sick, or the alarming nature of the symptoms. Tho' the distemper was violent, it yielded to medicine, and no kind of illness 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 timely care of the surgeons of their regiments. Of the *Greys*, and *Rothes's* dragoons, that were the most sickly, 31 died in all: which number will not appear great, if we reflect what a multitude of patients and bad cases (and those much dispersed) were under the management of so few hands*.

One of the most unfavourable circumstances attending this fever, was the proneness to a relapse; the danger whereof was greatest during the hot weather, less in the decline of autumn, and least of all after the

* Part I. ch. viii. p. 66.

frosts began. But, in the following spring, relapses became so frequent, that those regiments, which had served in *Zealand* in the preceding autumn, had 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 at last to end in a dropsy or jaundice. In this bad state of the *viscera*, was usually felt a hard tumour 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 swelling were opened, the part affected could not be ascertained. It was often accompanied with swelled legs, a distention of the whole belly, or with some other hydropical symptom; and whilst it remained, the fits could not be safely stopt by the Bark. It was a bad sign, but not mortal, since many who had it, recovered.

I have likewise met with some cases of the tympany, a distemper that seemed chiefly owing to a premature use of the Bark. 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 with such violence among the common men, it appeared generally in a much milder 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, that soon came to regular intermissions. The reason was, their having drier quarters, less exposition to the sun and fogs, the advantage of a better diet, and the use of wine.

§. 3.

Of the Nature and Cause of the bilious, or remitting and intermitting Fevers of the Camp, and that of low and marshy Countries.

THE autumnal fever of the camp and that of low and marshy countries being so much alike, it seems reasonable to refer them to similar causes.

One general and remote cause of both is a hot and close summer, attended with a moisture of the air, tho' without rain. Another, and a nearer cause, may be referred to putrid exhalations. But, the suppression of perspiration, or the admission of corrupted steams into the blood, at a time when it is most putrescent, seems to be the more immediate cause of the distemper. And the
actual

actual corruption of the humours may be considered as the *causa proxima*, or the very nature thereof.

To demonstrate this theory in a regular manner, it would be necessary to shew, that part of the perspirable matter is either actually putrid, or the occasion of putrefaction, when retained too long in the blood; and that all such retentions in hot weather are attended with a proportional degree of fever. But as these points would require too long a discussion for this place, I shall refer them to the authors who have professedly treated of them *, and to some remarks I shall make in the appendix.

I shall only observe here, that we are not to confound the ordinary checks given to perspiration in *Britain* (where the weather is seldom close, and hot for any considerable time) † with what happens in other climates, subject to such intemperature, and where the inhabitants having in summer and autumn great and uninterrupted heats, and thereby humours of a more putrescent nature, require a more constant evacuation of what is corrupted. How far a fever may

* SANCTOR. Med. Static. passim.

Si parcius est (perspiratio) oritur putredo, febris, &c. BOERHAAVE Institut. Med. § 778.

† What is said by SANCTORIUS of the winters in *Italy*, is more or less applicable to all the seasons in this island: *Adipneustia, quæ æstate malignam febrem, hyeme vix minimam alterationem efficere potest: corpora enim acris perspirabili æstate referta sunt, quam hyeme.* Med. Stat. sect. II. aphor. xxxv.

arise from a putrid ferment, may be learned from the shuddering, heat and sweat consequent upon the absorption of any purulent matter *.

Now, whether a foggy and moist air occasions a stoppage of perspiration by entering into the blood, or by its external application to the pores of the skin and to the lungs, is not here material; it being sufficient for our present purpose to take for granted, that those bad qualities of the air will cause an obstruction of the perspirable matter, in whatever manner they effect it †. And as moist air tends so much to relax the fibres, we should from thence infer a farther power therein to promote putrefaction. For, whatever relaxes, in general, disposes to corruption; and whatever braces may be considered as antiseptic ‡.

These things being premised, let us suppose, that in the end of summer or in the beginning of autumn, the perspiration is stopped; or, in other words, that the most volatile and corrupted parts of the blood are retained in the mass, whilst the humours are most disposed to putrefy, and then we shall easily conceive how this may bring on a feverish heat, with all the symptoms of a

* Suppuration is a species of putrefaction. Vid. Append. Paper III. exp. xvii. in the note †.

† In cœnoſo (aëre) prohibetur perſpiratio, fibræ laxantur, &c. SANCTOR. Med. Stat. ſect. II. aphor. viii.

‡ Append. Paper III. remark after exp. xvii.

common paroxysm * ; in which the profuseness of the sweat seems to depend upon the solution of the blood and laxity of the fibres. This not being the natural state of the body in winter, we find that common feverish heats are then seldom relieved by sweating.

When the sweat is abundant, the putrid parts of the blood are either wholly or in some degree expelled ; after which the fever is either entirely cured, abated, or brought to intermissions.

It is hard to account for the periodic returns upon any principle ; but easiest perhaps upon that of putrefaction. The heat of the body varies little, and therefore the corruption produced in any of the humours must happen in a determined time, longer or shorter, according to the nature of that humour. The size or inflammatory crust of the blood is soon corrupted, the *crassamentum*, a little slower ; but the *serum* remains a long time untainted in a heat equal to that of the human body †. Again, we may observe, that all substances corrupt sooner or later in proportion to their mixture with air, to the vent they have, or to the closeness in which they are kept. The corruption of bile is quick, but

* In autumnno augetur corporis pondus ; quod si excedat salubrem latitudinem, sunt tertianæ, seu aliæ putridæ. SANC-TOR. Med. Stat. sect. I. aphor. cxv.

† Vid. Append. Paper vii. exp. xlii.

not so high or offensive as that of the blood or the fibrous parts of the body*. These things considered, we may conceive how there may be returns of paroxysms at equal distances, and at shorter or longer intervals, according to the quality of the humour, its seat, its openness or confinement.

If we suppose, that in the paroxysm the more corrupted particles of the blood do not all pass off through the skin with the sweat, but that some part of them are discharged with the bile; these particles coming into the intestines, and being from thence taken up by the lacteals and carried into the blood, may there act as a new *ferment*†, and occasion a return of the fit. Thus, the corruption of the bile may be the effect of the first paroxysm, and the cause of those that ensue. That this is sometimes the case, may hence be deduced; whenever a vomit can act so powerfully, soon after the fit, as to evacuate the gall-bladder at once, the fever is either wholly removed, or made easier. But, from this instance I would not infer, that the corruption of the bile was the only cause of supporting the fever; since there are other circumstances that seem to indicate as if the *primæ viæ* were sometimes the seat of the putrid leaven, indepen-

* Ib. Paper i. exp. ii.

† This term is only used to denote the putrefying cause. Vid. Append. in a note subjoined to exp. xviii.

dent of the gall; and in continued or remitting fevers, it would appear as if the blood itself, not making a thorough separation of the septic particles, retained some part of them for maintaining the disease.

If these fevers, in general, arise from a putrid cause, how much more so must those that happen in marshy countries, where perspiration is not only impeded by the moisture of the air, but where the blood is corrupted by the *effluvia* of plants, insects and fishes, dying and rotting in the stagnating water. From this source the fevers are not only more frequent, but generally of a more malignant or pestilential nature*. Men breathing such air are constantly receiving into their blood a multitude of putrid particles which will pass off as long as the excretory passages are clear; but if these are stopped, the septic matter must infect the humours and at last bring on some putrid disease. Hence it is, that in marshy countries, during the sickly season, indigestions, colds, or whatever tends to suppress perspiration, is so apt to occasion a bilious fever or dysentery.

But, tho' from such principles we may account for the common symptoms of these fevers, yet the suddenness and violence, of those that appeared in the cantonements, would seem to be owing to some other cause

* Vid. Part II. ch. ii. §. 3.

than

than what has yet been explained. It will, therefore, be necessary to add some farther conjectures upon this subject.

When any greater quantity of putrid *effluvia* (especially such as are of a more virulent nature) are admitted into the blood, besides acting thereupon slowly, by way of *inquinamentum* or ferment, they seem immediately to affect the nerves, and thereby bring on some extraordinary disorder of the whole frame. Hence arise spasms, obstructions, palpitations, a high degree of fever, or a languid circulation, chilliness, or intense heat, and a variety of contrary symptoms, according to the different affection of the nerves. These facts are sufficiently known to such as have either given attention to the accounts of the plague, or had opportunities of seeing malignant and pestilential fevers. The *delirium*, inquietude, sinking of the pulse, the frequent but uncritical sweats, the great dejection of strength and spirits, symptoms appearing early, and attending this fever in its worst state, were a proof of the great disorder of the nerves; which are always the first parts that suffer upon the admission of any putrid *miasma* into the blood*.

But

* It is observable what a near affinity there is, even between the first symptoms of the true plague, and those of the ardent fever of the marshes. For, thus we find the former described at *Aix* in *Provence*, which received the infection from *Marseilles* :

But as to the suddenness and high degree of phrenzy, seizing many of those who fell ill in the cantonements near *Bois-le-duc*, that we must ascribe, in part to, their being long exposed to the heat of the sun, after taking in so much of a septic ferment from the early fogs, through which they passed when they went for forage.

Tho' these fevers arose from a cause not inflammatory, yet they soon become such by the violence of the paroxysms. For, we may easily conceive, that whatever occasions such burning heats, hæmorrhages of the nose, violent head-achs and phrenzies, must frequently be the cause of high inflammation. Hence it happens, that the bilious fevers, in their greatest rage, are always of a mixed nature, between putrid and inflammatory: a circumstance we must have particular regard to in the cure. But in the decline of autumn, when the weather grows cool, the bilious or putrid cause is weakened; whereupon the fits becoming moderate, the fever is commonly attended with little or no inflammation, is generally of a

seilles: Cette maladie commence ordinairement par un froid avec douleur de tête, abattement des forces et envie de vomir, un feu brulant dans les entrailles, une soif insatiable—le pouls concentré. V. Traité de la peste, p. 217. Add to this, that the plague appeared sometimes in the form of a double tertian: il arrive, mais rarement, que le mal se masque par tous les signes d'une fièvre double tierce; et ce déguisement dure tout au plus jusques au troisième accès, et alors il se démasque par tous les symptômes susdits de peste, tant intérieurs qu'extérieurs, Ib. p. 218.

regular

regular type, and has full intermissions. This was the case in the cantonements*; and such fevers are observed to run the same course in all other marshy countries. But in camps, tho' in the decline of autumn, the fevers tend likewise more to intermissions, yet from the colds, the soldiers are at that season more exposed to in the field than in quarters, some degree of inflammation is usually joined, sufficient to prevent a thorough *apyrexia*, and to keep up the remitting form.

I should now proceed to the cure; but as it may be proper to examine these principles, by considering what shape the diseases 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 have made the most careful observations.

§. 4.

The Bilious Fever of the Camp and Cantonements 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, imperfectly known. It is described as a malignant fever, attended with sickness at the stomach, a pain and hard-

* See Part I. ch. viii. p. 67.

ness about the epigastric region, great thirst from the beginning, a parched tongue, and a constant head-ach ending in a *delirium*. These were the common symptoms, to which were added, for the most part, petechial spots or blotches. The distemper was highly contagious and mortal; tho' it usually run out from 14 to 20 days. It was first taken notice of in the year 1566, appearing in the *Imperial* army in *Hungary*, and thence spreading over a great part of *Europe*. As I have met with no author that was an eye-witness, I shall take the liberty to infer from this account, which we have from *Sennertus**, that the *Hungarian* malady was a compound of the bilious and hospital-fever, taking its rise first in the camp, but acquiring that high degree of malignity from the foul air of the places in which the sick were crouded. It appears from all accounts, that the climate there is one of the worst to an army in the field; which is easily understood, from the cold and damp nights succeeding the sultry days in a marshy country†. And since the autumnal fevers and
fluxes

* De morbo Hungarico.

† The moisture of that country is only to be understood 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 these rivers, the troops on that account have been very liable to diseases.

fluxes are more frequent and worse in *Hungary* than elsewhere, in order to account for the great mortality and pestilential nature of this epidemic, we need only suppose, that the weather that year was close, and more than ordinarily unwholesome throughout *Europe*, that the sick were crowded together, and 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.

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 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 in that season from the *Carpathian* mountains, reputed 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, 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 he had made of the autumnal fever incident to the Queen's troops in *Hungary*, not only with regard to the symptoms, but the cure by the Bark, which he first had given in that distemper. And 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 the *Low Countries*.

* This circumstance is mentioned by SENNERTUS, vid. *loc. cit.*

At

At *Copenhagen*, in the year 1652, a fever began in autumn, after an unusually hot and dry summer*. The city is situated in a low and marshy country. The fever was accompanied either with quotidian or tertian paroxysms, with bilious vomitings, a burning heat, violent head-achs, frequently a *delirium*; and with petechial spots, that came out in the fits, and disappeared in the remissions. These, with an extraordinary debility, indicated the malignant nature of the fever, farther ascertained by its ending in profuse sweats, abscesses, a *diarrhœa*, or dysentery. The author of this account, *Thomas Bartholine*, upon dissecting the bodies, and finding the stomach and *duodenum* always inflamed or mortified, assigns these parts as the seat of all malignant fevers.

In the year 1669, a like fever raged at *Leyden*, described by the famous *Sylvius (De le Boe)*, † who lived at the time and practised there. The situation of this place is also very low and damp. The spring and beginning of summer were cold, but the remainder of summer and autumn were exceeding hot, with little or no rain, and with a constant calm or stagnation of the air. The water of the canals and ditches was highly corrupted; and the more so, as the author observes, by an

* BARTHOLIN. *Histor. Anatomic. Rar. cent. II. hist. lvi.*

† *Prax. Med. append. tract. x.*

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, that argued an extraordinary resolution and putrefaction of the blood. And yet, what is strange, *Sylvius* ascribed the cause to a prevailing *acid*†, and treated the distemper accordingly; so that we cannot help remarking, that the great mortality among the principal inhabitants of that city (of which, he says, two thirds died) may have been owing, in some measure, to the method of cure by absorbents and other medicines, agreeable to the notion that ingenious and learned author, 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‡.

* The reasons of this may be learned from the experiments in the appendix. Paper III. and IV.

† *Sylv.* Prax. loc. cit. DCXXVII.

‡ Part I. ch. i. p. 5. Part II. ch. ii. §. 2.

But

But, the bilious 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 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 incident to low and wet 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 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 no less than fifteen plagues mentioned by *Livy*‡: which yet from other circum-

* Vid. *CELS.* de Medicin. lib. I. cap. x. lib. III. cap. vii.

† De Temperam. Lib. II.

‡ *LANCISIUS* reckons up several more from the same author, Vid. *Dissert. de Advent. Roman. Cæli Qualit.* cap. III.

stances, 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 shores were made, *Rome* became much more healthful; and then only the low and wet places of *Latium* remained sickly. Afterwards, when the city fell into the hands of the *Goths*, the drains being stopt, and the aqueducts cut, the *Roman* territory became one continued marsh; which for a series of years occasioned an incredible desolation*. And tho' 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 *Lancisus*, added to his excellent account of those epidemics, are a full proof of their putrid nature†.

Altho' 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

* Id. loc cit.

† De Nox. Plaud. Efflav. lib. II. epid. I. cap vi.

of this kind is described in the epidemics*; at which time the diseases were ardent, remitting and intermitting fevers of the worst kind, attended with fluxes, parotids, and eruptions of a pestilential nature.

Prosper Alpinus observes, that the stagnating canals at *Grand Cairo* breed every year a malignant kind of small-pox, and also the putrid and pestilential fevers, that prevail in *March, April* and *May*; which the constant 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*. These 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 cities every year, it is not surprizing, if in seasons uncommonly hot and moist they should be raised to a true plague. For, altho' the learned author asserts; that the true plague is not properly indigenous to *Egypt*, but is brought thither from *Greece, Syria*, or the more southern parts of *Africa*, yet he owns that it sometimes begins there, after extraordinary inundations of the *Nile*; when the water extending itself beyond the usual drains, re-

* Lib. III. §. iii.

† De Medicin. Ægyptior. Lib. I. cap. xiv.

‡ The author's phrase is, *bilis virulenta*.

mains on the land, and forms into 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 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, by the exhalation whereof, the air is rendered moist, foggy and unhealthful. *Bontius* observes, that at this time the humidity is excessive, and that even in the dry months, the metals rust†, and the cloaths rot in that country sooner than in any part of *Europe*. Nevertheless, the plague is unknown in *Java*; tho' from these circumstances one might expect that this island should be much exposed thereto. But we are to consider, that when the sun is most vertical in that country, it is also most clouded; by which means, and the continual interchanges of the sea and land-breezes, the heat of the air is considerably moderated,

* 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 been told by a gentleman, who made the experiment in *Jamaica*, that two iron rusts very soon in that island, yet that salt of Tartar seemed to attract moisture from the air more slowly there than in *Britain*. 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.

and

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 and a vomiting of bile of various colours, but chiefly green. The extremities grow cold, whilst the inward parts burn, 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 medicine remarkable for an antiseptic as well as a cordial quality†.

The *British* settlements in *Guinea*, are as near the line on this side, as *Java* is on the other. On that coast, the rainy season continues throughout *April*, *May* and *June*. In *July* and *August* the weather is sultry, and remarkably moist and foggy, from the stagnating water and the woods abounding in that country. During this season, remitting and intermitting fevers, with quotidian paroxysms, are epidemic. These are always accompanied with extreme thirst, a *nausea*, and great inquietude; frequently by a vomiting and purging of a putrid bile: nor does the fever usually abate till that is evacuated. If a discharge of this humour is not

* BONT. Method. Medendi Cap. xiv.

† Append. Paper II. exp. xi. Paper III. exp. xvi.

made in time, the distemper assumes a continued and malignant form, the pulse sinks, and a *delirium* comes on, generally fatal. Fluxes are likewise frequent at this season: and both fever and flux are no 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 constant haziness of the weather, during the greatest heats, seem to be of the same use as at *Java*, for preventing the plague*.

Neither do the bilious fevers of the *West-Indies*, tho' of a very putrid nature, ever turn to a true plague; because the same kind of breezes prevailing there, hinder that degree of stagnation and corruption of the air 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 such as have lived above a year in the country. But the newcomers are liable to a continued, a more pu-

* This account of *Guinea* I had from a surgeon, who lived some years in that country.

trid and dangerous fever*; which, tho' not confined to any certain time of the year, coincides mostly with the former. This last is distinguished by vomitings of a matter, sometimes green and bilious, at other times black and bloody; but chiefly by the yellowness of the skin. The blood is also much resolved†; so that, before death, it enters the serous vessels, tinging the *saliva* and the humour discharged from a blister‡.

Before I conclude, it may be proper to take notice, that we have also fevers of a bilious kind in this island; and that both our remitting and intermitting fevers and dysentery, seem no less the effects of 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 perspiration, and the moderate and interrupted heats of our summers, that, unless in extraordinary hot and close seasons, and in the fenny tracts, these distempers are always gentle, and seldom or never epidemic. At the same time,

* This is commonly known by the name of the *yellow fever*, or *black vomit*. The difference of these two is taken notice of by Dr. WARREN (in his treatise concerning the Malignant Fever of *Barbadoes*, p. 2.) and tho' it does not appear that there was any ground to trace this last fever from some infection brought from *Europe* to *America*, yet it seems to be a disease of a malignant or pestilential nature.

† This always imports putrefaction. Vid. append. Paper vii.

‡ Dr. WARREN mentions many symptoms, indicating a putrefaction of the humours, and nervous spasms consequent thereupon.

I am apt to think, that the small degree of putrid acrimony, to which our blood is liable, may be the reason of our overlooking it altogether, at a season when it is most incident; and that, instead of evacuating or correcting what is amiss, we often neglect it, till it creates some fixed disorder in the *primæ viæ*, or ends in obstructions of the *viscera*. So that hence may proceed scorbutic symptoms, nervous complaints without fever, or fevers of a nervous kind; instead of fluxes, intermitting or remitting fevers, the common consequence of a more sudden and thorough corruption of the humours.

In fine, during the latter part of summer, or throughout autumn, there seems to be in most places a tendency, more or less, to these remitting or intermitting fevers; or to some disorders of the *primæ viæ*, proceeding from 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 explained*.

To this theory, about the corruption of the humours, two objections will naturally occur; one from observing how readily these fevers, when free from inflammation, yield to the Bark; and the other, how often they appear in the spring, before there has been any heat to occasion putrefaction. For an answer to

* Part I. ch. i. Part II. ch. ii. §. 2.

the first difficulty, I shall refer to the experiments made on the antiseptic qualities of that medicine*: but as to the second, I shall endeavour now to remove it.

We may observe, that the fibres are more relaxed in the spring than in winter; hence, the body becoming more plethoric, that the humours will be then apter to corrupt, upon any suppression of perspiration. And this, perhaps may be forwarded by the *effluvia* arising from all putrid substances, which being lockt up during the cold of winter, are then set at liberty by the greater heat of the sun. But, whatever are the causes of the vernal intermittents, it is certain, that they are never nearly so frequent, nor attended with such malignant symptoms, and marks of putrefaction as the autumnal.

Upon the same principles, we may account for the disappearing of these diseases in the beginning of summer. For, the perspiration being then more plentiful and constant, the redundant humours are discharged; and the sun having exhaled all that was already putrid, is not yet hot enough to corrupt the stagnating water.

All the vernal remittents are attended with great sickness of blood, from the colds taken upon the first encampment: so that both the first and last fevers of the cam-

* Append. towards the conclusion of Paper II. paign

paign are, on this account, to be considered as more of an inflammatory than of a bilious or putrid nature.

§. 5.

*Of the Cure of the bilious Fever of the Camp,
and that 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 *species* of fevers, as before; and then I shall mention such remedies as I have found most successful, forming rules from my practice only, independent of any theory. For, tho' it is usual to take the indications of cure from the nature of the disease, yet as I have deduced the preceding theory rather from the cure, than the cure from the theory, it seems just to offer this part as the result of experience alone.

I. THE cure of the *camp-fever*, before it becomes continued, depends upon the proper use of evacuations, the neutral salts and the Bark.

Bleeding being indispensable, it is the first thing to be done in every case, and is to be repeated once or oftner, according to the urgency of the symptoms. The vernal and latter autumnal remitting fevers are accompanied

panied with pleuritic and rheumatic pains, and other signs of high inflammation; and on that account require more bleedings than are necessary in the intermediate season. A person unacquainted with the nature of the distemper, and attending chiefly to the paroxysms and remissions, may be apt to omit this evacuation, and to give the Bark too soon, which would bring on a continued 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 coming 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, that preceded the paroxysms of those fevers he describes: at which time bleeding might indeed be improper. But, as the paroxysms of our fever were generally without any cold fit, his caution was not to be minded; nor any other, except the common one, of not bleeding during the sweat.

* Quod si vehemens febris urget, in ipso impetu ejus, sanguinem mittere, hominem jugulare est. De Med. lib. II. cap. x.

After

After bleeding it is necessary to give an emetic; and the best time is in the remission or intermission of the fever; and rather soon after a paroxysm than before one. There is some difficulty in determining the kind of vomit; and sometimes it may be doubtful whether any is proper or not. Vomits do harm when the stomach is inflamed, or whenever the fever has been of some standing and assumed a continued form. But withal, it must be observed, that an inflammation of the stomach is a rarer occurrence than one would imagine, amidst so many complaints of vomiting, pain, sickness and oppression about the epigastric region; all which being commonly relieved by an emetic, we may safely give one, as soon as the fever intermits, or is attended with considerable remissions. The *ipecacuanha* is the safest and easiest, but the antimonials are the most efficacious. If the remissions are small, or the fever great, or if there is already a tendency to vomit, the Root is best; but when the remissions are distinct, or the intermissions perfect, the antimonials are preferable, either by themselves or joined to the former. I commonly added two grains of emetic tartar to a scruple of *ipecacuanha*. The vomits, that are also productive of stools, are the most useful; but especially if they are powerful enough to procure a plentiful discharge, upwards or downwards, of the corrupted

rupted bile. By this means they sometimes effect a cure without farther medicines.

But, if the body remains costive, it is necessary to open it with some lenient physic; and especially if the bowels are affected with pains, or a *tenesmus*.

The neutral salts are useful in bringing the fever sooner to regular intermissions. The saline draught, made with salt of wormwood and lemon-juice, is one of the best forms for this intention, but too costly for common practice; and therefore, in lieu of them, we have used the following mixture:

R *sal. absinth. dr. i. sem. solv. in aq. fontan.*
unc. x. et instill. spirit. vitriol. q. s. ad
saturat. add. aq. cinnamom. spir. unc. i.
sem. syrup. e cortic. aurant. unc. i. misc.
Cap. quarta vel sexta quaque hora cochl. iv.

The *spiritus Mindereri* may be given to the quantity of an ounce or more (divided into two or three draughts), when the sweats are not profuse enough in proportion to the hot fits: and the proper time for administering this medicine is before they go off. As it promotes a plentiful *diaphoresis* without heating, we may expect it will bring the fever sooner to regular intermissions.

I come next to the Bark, and shall observe, that tho' these fevers are never without inflammation in the beginning, and rarely have complete

complete paroxysms; yet, when the urine breaks, and there are entire tho' short intermissions, it may be safely given. I have taken notice how readily this disease puts on a continued inflammatory shape, upon giving the Bark before bleeding; I shall add, that it was no less dangerous to prescribe it before the first passages were cleared: for, without this precaution, either the fever returned, or a *tympanitis** succeeded. The Bark answers best in substance, in *Rhenish* wine, after standing a night in infusion; but for common practice it was made into an electuary, in which, to an ounce of the powder, a drachm of crude *sal ammoniacum* was added. If the patient was not purged, I found it necessary to join as much rhubarb as kept the body open, for the first two or three days of taking that medicine. This practice is recommended by *Lancisus*† and *Dr. Mead*‡, and is chiefly useful when the bilious or putrid humours abound, as they mostly do in marshy countries. As the paroxysms were generally quotidian, and the intermissions short, it was sometimes necessary to begin with the

* These sudden swellings of the belly, upon the premature use of the Bark, were first taken for ascitical; but afterwards I had reason to think, that they were all of the tympanitic kind: see the next section.

† De Nox. Palud. Effluv. lib. II. Epidem. IV. cap. vi. sect. xxvi. et TRAVERSAR. Ep. ad LANCIS. Ib. Epidem. IV. cap. viii. sect. xxi.

‡ Monit. et Præcept. Medic. cap. I. sect. viii.

Bark before the sweat was quite over, in order to prevent a return.

These are the chief rules to be observed in the beginning of the fever, or in its continued form, before the remissions appear; and also in its remitting and intermitting state. But if the disease has been neglected in the first stages, or if, after remissions or intermissions, it changes into a continued fever, a vein must be opened, if the pulse is full and hard; but if the head is affected, either with a *delirium* or pain, and the pulse is small, it will be more expedient to apply leeches to the temples. But, whether there be room for bleeding or no, blisters are not only useful, but the best remedy. At this time, neither vomits nor purges are proper, however the *primæ viæ* may be loaded; but clysters, and lenient physic are necessary for evacuations; tho' these too are not always to be repeated without caution. To these remedies should be added the neutral salts, such as have been just mentioned, or the diaphoretic powders or mixture prescribed in the first chapter of this part.

But, tho' a sweat be the proper *crisis*, we are never to move it by the *theriaca*, volatiles, or the like hot medicines; unless the pulse should sink, and the *petechiæ*, or other bad symptoms appear: in which case it will be necessary to use the warmer alexipharmacs,

and to treat the disease like (what it is in effect) a malignant fever*.

Sometimes it changes into a dysentery, to be managed in the manner directed in the following chapter. But if a *diarrhœa* comes on, tho' it is never to be stopt suddenly, it will often be convenient to restrain it gradually by opiates, and afterwards to promote a *diaphoresis*. Tho' a looseness is the least favourable *crisis*, yet if nature points that way (by colic-pains or a tension of the belly, attended with a driness of the skin), it will be proper to procure stools by clysters, or some mild laxative, such as the infusion of rhubarb with manna, to be repeated, according as the patient can bear the evacuation.

II. The *camp* and *marsh-fevers* are not more alike in the symptoms than in the 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 requires large bleeding; but, in general, as the humours have here a very putrid tendency, or are indeed putrid, this fever admits less of that evacuation than the camp-fever; where from frequent and great colds the blood becoming more fizy, fixes the inflammation. In most cases,

* Vid. ch. vi.

it was necessary to open a vein, either on the first attack or the next day, if there was no intermission. But repeated bleedings, unless upon evident marks of inflammation*, were so far from producing this effect, that they were apt to render the fever more malignant. It will also be proper to remark, that the rule about bleeding regards the army only, and not the inhabitants, in general, of the *Low-Countries*, as having constitutions so very different from those of our men, who were not only young, but robust and sanguine. And even amongst the soldiers, bleeding was not always necessary upon a relapse, or after the weather grew cool; as the fever appeared then without inflammation, and with perfect intermissions.

I observed, that vomits were still more efficacious here than in the camp; in so much, that when the bile was thoroughly evacuated by an emetic, the fever would often be removed at once. But this was not to be obtained by the *ipecacuanba* alone, which I have seen have a contrary effect, in making the next paroxysm longer and more violent than the preceding; whether by acting weakly, and sending more of the corrupted humours into the blood than it discharged from the *primæ viæ*, or from

* As in the case of those, who, in the cantonments near *Bois-le-duc*, during the heat of the season, were suddenly seized with a high fever and *delirium*.

some other cause, is uncertain. For this reason, I commonly added the emetic tartar.

The *marsh-fever*, during the warm season, being more apt to run into double paroxysms, or to change into a continued form, than to remain in the intermitting shape, it was, therefore, 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 tho' large quantities were given, relapses were not only frequent, but certain, if the medicine was not repeated oftner than the soldiers could generally be prevailed upon to take it. So that, upon the whole, the Bark was less useful than what might have been expected. But it will be proper to observe, that no bad consequence arose from repeating it often; for, the visceral obstructions that succeeded to these fevers, were not to be imputed to the quantity of the Bark, but to a long continuance of the disease, or to frequent relapses: against which there was no security, unless the patient continued to take an ounce of the powder, once every ten or twelve days, throughout the autumn. The most effectual way to make a soldier continue taking it, in order to prevent a relapse, is to infuse it in gin or brandy.

The next means of prevention consists in a proper regulation of diet. The convalescents must eat moderately, especially of greens, and

are

are to abstain from fruit, new small-beer, and whatever is flatulent, or tends to relax. In general, whatever produces such effects, disposes to putrefaction; 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, in the marshy countries, for providing both wholesome food and strong liquor, it would be advisable, that the public should make, at such times, an allowance of spirits to the army, as it does to the navy: tho', perhaps, half that quantity might be sufficient.

§. 6.

Of the Cure of Obstructions, consequent on the Bilious Fever of the Camp, and that of marshy Countries.

A Long continuance of these fevers, or frequent relapses into them, bring on visceral obstructions, ending in a dropsy or jaundice.

The dropsies are chiefly owing to obstructions of the liver and spleen; in which case the watery swelling generally begins at the feet, and rises gradually to the belly. But when this alone is swelled, and that suddenly, after the unseasonable use of opiates in the dysentery, or of the Bark in intermittents, the

distemper is to be considered as a true *tympanitis*, tho' often confounded with the dropsy.

In the *tympanitis*, if the patient is full of blood, begin with bleeding; if not, it will be sufficient to give every night a small dose of rhubarb (just enough to keep the body open), with a few grains of the *species aromaticæ*. After the swelling gives way, some strengthening medicine is to be added, in this manner.

℞ *flor. chamæmel. (cum syrup. e cort. aurant. q. s. contus.) zingiber. pulv. aa. dr. ij. chalyb. cum sulphur. præp. dr. i. f. electar. Cap. bis die mol. nuc. moschat. maj.*

All strong phyfic, or carminatives without laxatives, are hurtful.

A man who had been some weeks ill of a *tympanitis* died suddenly, upon the swelling subsiding, all at once, after three or four loose stools. 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 enough of wind to have been the cause of the tumour. This case suggested the necessity of using a swathe in the *tympanitis*; by means of which the patient may always make a compression, suitable to the decrease of the air in his bowels.

The

The *ascites* comes on more slowly, and is generally attended with anasarcaous swellings, a paucity and thickness of urine. Sometimes the fever goes off when the swelling begins, at other times it continues, or comes and goes in an irregular manner. These dropfies are 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 thirty or forty grains of salt of tartar were dissolved in an infusion of wormwood, to which was added spirit of juniper; and this mixture was taken at three doses, and repeated daily. The patient had no other medicine, except once in four or five days, half a drachm 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 swallowing garlick, or mustard-seed. Tho' the *ascites* was accompanied with the hard swelling formerly mentioned*, nothing was farther done, except sometimes fomenting the part, or covering it with a warm plaister. Irregular and obstinate intermittents have been removed by the same medicines: or, if they returned after the cure of the dropsy, they were then successfully treated with the Bark.

* Ch. iv. §. 2. p. 179.

The jaundice without fever was likewise cured by the lixivial salts, and the same physic: and both in that distemper and in the dropfy I have observed good effects from antimonial vomits.

C H A P. V.

Observations on the CAMP-DYSENTERY.

THE bilious diseases of the camp were divided into fevers and fluxes*; of the first I have treated at large; but as to the last, I shall confine myself to that *species* called the dysentery, as it is the least known out of the field, but 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 enquire into its nature and cause; and lastly propose the cure.

§. 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 close of summer, or in the beginning of autumn. At that time, they become epidemic

* Part II. ch. i.

and contagious, prevail for about six weeks or two months, and then cease. They are always worse after hot and close summers, especially in fixed camps, or when the men lie wet after a march in warm weather.

The sure diagnostics of the dysentery, are small but frequent stools of a slimy and frothy matter, a *tenesmus*, and gripes. Blood mixed with the *fæces* is a common, but not an inseparable 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 whereas this distemper is mostly attended with blood, for that reason it has also the name of the bloody-flux.

The other symptoms are more casual. Sometimes a violent bilious fever will terminate in the dysentery; at other times the previous fever is inconsiderable; and now and then we shall find the dysentery begin with scarce any feverishness at all. In general, the fever attending the flux is of little consequence, till the disease has continued long, and the patient is exhausted; then it is of a low and malignant kind.

The first stools are usually large and bilious, afterwards they are small but frequent, consisting chiefly of *mucus* mixed with blood.

Streaks of blood denote the rupture of some small vessels in the *rectum*, but a more intimate mixture is a sign that the blood comes

from a higher source. This evacuation of blood, which alarms most, is the symptom least to be dreaded; for tho' the oozing is constant, except in a few cases, the quantity of blood lost in the course of the disease is inconsiderable. Upon the approach of death the stools become less bloody, that is, less red; for the blood is then converted into a putrid *ichor*.

In general, tho' the motions are frequent, yet the evacuation is not great; except in the advanced state of the flux, when a lientery supervenes, in which the aliment passes through undigested. The stools therefore chiefly consist of the *mucus*, which being removed from the intestines, their villous coat is abraded, and at last voided. Besides this, we shall sometimes, tho' less frequently, observe in the *faeces* certain substances like bits of suet, and sometimes small hardened *scybala*, or round worms. As neither of these two come away all at once, or appear in the beginning, they keep up the irritation, and protract the disease.

These are the chief substances to be distinguished in the stools of those who labour under a true dysentery; for, when purulent matter is voided at first, or at any time unmixed, it is a sign that the distemper is of a different nature. Not, but that the intestines are liable to ulcerate in the dysentery; but so late, that the matter is either changed into a
putrid

putrid *sanies*, or so blended with blood and *mucus* as not to be seen.

The *faeces* have all along a putrid smell, especially after the mortification begins, and then they are most infectious. The gripes are generally vague, but sometimes there will be a fixed spasm in one part, causing exquisite pain. Altho' a great deal of wind is evacuated, yet as it is soon regenerated, the gripes and *borborygmi* become almost incessant. The stools are all preceded by sharp gripings, and succeeded by some little respite: but the motions being so very frequent, the patient can have no considerable ease, unless from opiates, sweating, fomenting the belly, or after a purge.

In the beginning, the stomach is usually affected with a *nausea* and sense of oppression; and tho' it is relieved by vomiting, yet the indigestion remains, by which all kinds of food turning either sour or putrid, more wind is produced, and the gripes are continued. A hiccup sometimes arises from this cause, and then is little to be dreaded; but in the low or advanced state of the disease, when that supervenes, it is generally the sign of a mortification of the bowels, and fatal.

The falling down of the gut, is a consequence of the *tenesmus*; and a strangury, of the irritation of the neighbouring parts. The disease ends in a total prostration of strength, a low and malignant fever, sore throat

throat or *aphtæ*, involuntary and cadaverous stools, and last of all, in a release from pain, with all the signs of a gangrene.

The duration and issue of the dysentery are uncertain, so much depending upon medicine, good air, attendance, and the care the patient takes of himself. If nothing is wanting, and the flux recent, it may be easily cured: but these favouring circumstances can only concur amongst officers. 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. Add to this, that no distemper is more subject to a relapse; and that frequent relapses, by relaxing the tone of the intestines, and eroding their villous coat, bring on at last an habitual *diarrhæa*, that hardly admits of a cure.

§. 2.

Of the Dissections.

HAVING described the dysentery, I shall next relate the changes observed in the bodies of those who died of it.

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

and *tenesmus* were violent and incessant, and his stools no longer bloody, but of an ichorous colour. On the third day after his arrival, the pains abated, his pulse sunk, the extremities grew cold, a slight *delirium* succeeded, and he died on the fourth.

Upon opening the body, I found the larger intestines black and putrid, the coats præternaturally thick, and on the inside much ulcerated, especially in the *rectum* and lower part of the *colon*. The villous coat was either wholly abraded, or changed into a corrupted slimy substance, of a greenish colour; not only in the part described, but also in the *cæcum* and its *appendix*. Yet these were less corrupted, and the smaller intestines and stomach were neither mortified nor discoloured, but only distended with air. The fat of the *omentum* was also greenish. But neither the liver nor spleen seemed to be tainted, and the bile was thick and ropy, and of a dark hue. That part of the *vena cava* which lay on the *vertebræ* of the loins was extremely tender. The lungs adhered a little to the left side, but were otherwise sound. In the right ventricle of the heart, the blood was wholly clotted; but in the larger vessels it was partly fluid, and of a blackish colour.

2. About the same time, a soldier of the Train, after recovering of a common flux, was seized with a dysentery upon drinking, whilst hot, on a march, an immoderate quantity
of

of some cold liquor. Three days after, he was brought into the hospital very ill; and besides the common symptoms, he complained of the piles and gravel. This man could not lie down, but continually supported himself on his knees and hands, leaning his head forward upon the bolster, till his death; which happened three or four days after admission.

Upon opening the *abdomen*, I observed, that the greatest part of the *omentum* lay over to the left side, under the smaller intestines; but that it was large and full of fat. The liver was small and sound; but the gall-bladder was of an uncommon size, and full of a dark coloured bile, thin, but somewhat curdled. The biliary ducts were clear. The *pancreas* was in a natural state. The spleen, tho' of a common shape, was of an extraordinary bulk, being little less than the liver, and weighed three pounds eleven ounces: but it was otherwise sound, without indentations, having only, upon the side next to the blood-vessels, a small protuberance like the *portæ* of the liver. The kidneys were small and flaccid, and the *pelvis* of both, especially that of the left side, 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 exceeding putrid; and from thence the gangrene seemed to have spread to the *colon*, which

which was greatly mortified, and chiefly towards its lower end. The villous coat was partly consumed, and what remained was blackish, tender, and easily separated. The vascular coat had the appearance of a preparation well injected with 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; but the rest, with the smaller intestines, were of a firmer texture, only inflamed: 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* was 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 coagulated blood, of a coriaceous firmness, that did not adhere to the *sides*, but was entangled with the tendinous fibres of the *valvulae semilunares*, which passed through it. Both the *sinuses* were full of blood, partly congealed, partly fluid, and very black.

3. In the same season, a foot-soldier was sent into the hospital, supposed 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
ankles

ankles were a little swelled, but he made water freely. His cheeks were florid, whilst the rest of the face was pale. By his own account, he had been taken ill of a bloody-flux, about three weeks before, which being suddenly stopt by some drug, given him in the camp, his belly then began to swell.

This man, soon after admission, was seized with an inflammatory fever, of which he recovered, and then took such medicines as were judged proper for curing a *tympanitis*; during the course of which, a looseness coming on suddenly, one night, his belly subsided all at once, and he died before the morning.

The body was opened about thirty hours after; but in that time so much air had been generated anew, that the belly had swelled again, tho' not so much as before. There was no air, and scarce two spoonfuls of water in the cavity of the *abdomen*; but all the intestines were much inflated, except the *colon*; which, tho' 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 weighed about ten pounds. Its substance
was

was tender, and in the posterior part, next the diaphragm, was found a large abscess. The gall-bladder was of a moderate size, and full of a thin darkish bile. The lungs were found. We found little or no water in the *thorax*, but more *serum* than usual in the *pericardium*. The heart was small, without any clot, or even almost 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 malignant fever, succeeding a dysentery. His pulse was then low, his tongue parched, his cheeks florid, but his body wasted. He complained of great debility, of pain in his bowels, of a looseness, and retchings to vomit. In a few days after, he was seized with a hiccup and died.

Tho' the body was opened the next day, the smell was intolerable. The intestines were wholly mortified, and the stomach partly so. The outward coat of the liver was also putrid; and in the substance, were several abscesses, containing a purulent or ichorous matter. The spleen was likewise corrupted;

* From the late ingenious theories of the learned professors SIMSON and WHYTT, we are to ascribe this man's death to the trunk of the *vena cava inferior* being suddenly freed of the compression made by the air in the bowels, in consequence whereof the return of the blood to the right ventricle of the heart would be retarded, and that muscle of course cease from motion. See SIMSON's Inquiry into the Vital and Animal Actions, Ess. II. and WHYTT's Essay on the Vital Motions of Animals, sect. III.

but

but the kidneys, heart and lungs appeared to be sound.

These were the only dissections made of those who died of the flux, or soon after it was stopped. For, tho' I wanted not opportunity of opening more bodies, yet finding these cases agree so well with the observations of the authors collected by *Bonetus* *, I thought it unnecessary to pursue the enquiry farther; especially as there was enough to ascertain the putrid nature of the disease in its last period; and since I could be assured that no number of dissections, of men dying of the dysentery, after it had continued for some days, would determine its internal and more immediate cause.

§. 3.

Of the Nature and Cause of the Dysentery.

THE remote, external and predisposing causes having been already explained †, I shall not repeat them here, but proceed to enquire into the internal and more immediate cause, which is less obvious; omitting the many conjectures of others on this head, and only mentioning what seems to me most probable, to account for the various symptoms of this disease.

* *Sepulchr. Anatom. lib. III. sect. xi.* I find the same confirmed by some late dissections mentioned by Mr. CLEGGHORN. See his *Observations on the Epidemic Diseases of Minorca*, p. 227.

† Part I. ch. iii. p. 20, and seq. Part II. ch. i. p. 74. ch. ii. §. 1, 2, 3.

It seems, therefore, reasonable to believe, that the dysentery is owing to a cause little different from what produces the bilious fevers already described. The antients deduced both from an abounding and corrupted bile: but how far that opinion is true, and how to be qualified in regard to fevers, has been already said*. I shall only add, that in both cases the vitiated humours may be turned upon the *primæ viæ*. In the smaller intestines, they may be absorbed by the lacteals, and after producing a paroxysm, be partly discharged by sweat: but, if the putrid *fomes* is conveyed to the *cæcum* and *colon*, it can neither be well absorbed, nor removed from thence, on account of the *rugæ*, cells, and flexures of those parts. The first case gives the idea of a remitting or intermitting fever; and the last, that of a flux.

But however this be, it is plain that there is at first little difference between the causes of the two, considering, that the fevers begin to be frequent in camp whilst the dysentery still subsists; that the distempers sometimes change into one another; that when any number of men are exposed to colds in autumn, part will be seized with a remitting fever, others with this flux, and perhaps a third sort will have a disorder compounded of both. Add to this, that the first symptoms are similar, and that the epidemic remitting and

* Vid. Part II. ch. i. p. 74. Part III. ch. iv. §. 3.

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inter-

intermitting fevers of a more malignant kind have often ended in a bloody-flux*. Lastly, that such countries as are most subject to bilious fevers, are likewise most liable to the dysentery.

All authors agree in ascribing it to an acrimony; but what that acrimony is, they either have not defined at all, or seem commonly to have mistaken. It appears to be of the putrid kind†: which has been the less attended to, from a notion, that the humours would become more offensive by putrefaction than, from what is voided, they have observed to be the case. But in answer to this, it may be remarked, that the bilious and serous humours, tho' putrid, are less offensive than most other animal substances in the same condition‡. Again, that this malady is most frequent in hot, close and moist seasons, when bodies are most subject to putrefaction; and that it prevails chiefly among such as are of a scorbutic habit, or the meanest and poorest people, who, from foul air, bad diet and nastiness, are most liable to putrid diseases. There is also an old observation, that such seasons as produce most flies, caterpillars and other insects, (whose increase

* THOM. BARTHOLIN. Hist. Anatom. Cent. II. hist. lvi.

† This is agreeable to the sentiments of DEGNERUS (*vid. Histor. Dysent.*); tho' that learned author, like others, has not distinguished between *putrid* and *alkaline*. Compare Append. Paper I.

‡ Vid. Append. Exp. ii. xlii. xlv.

depends

depends so much upon heat, moisture, and consequently upon corruption) have likewise been the most productive of dysenteries. Lastly, that the infection is evidently communicated by the *fæces* of those who are ill of the distemper.

For, the dysentery may proceed from two causes, different in appearance, but in effect the same; one, from acrimony generated within the body; and the other, from foul steams, which being received into it, act as a ferment, and suddenly produce the same disorder that arises more slowly from an internal cause. A remarkable case once occurred to me, of a person seized with a true dysentery, upon smelling to human blood, become putrid by standing some months in a close vial.

At first the smaller intestines seem chiefly affected; but upon the humour's descending into the *colon* and *rectum*, and stagnating there, the corruption increases; so that these parts may at last inflame and mortify at a time, when, perhaps, the bile is no longer putrid, nor the higher intestines the seat of the disease.

The putrefaction will also account for the great flatulence attending this distemper. For, corrupted animal substances not only yield air of themselves, but occasion, as will be shewn elsewhere*, violent fermentations

* Append. Paper V. Exp. xxxvi.

in all vegetable aliments. Hence arises such a quantity of air, that if it is pent up by opiates, it will be apt to distend the bowels and bring on a tympany.

The frequency of the stools may seem to argue an increase of the peristaltic motion; but it is to be imagined, that tho' this is quickened by the constancy of the *stimulus*, it must prove, on the whole, less expulsive, from the inability of the fibres to contract, after being so much relaxed by putrefaction. Of this, the *scybalæ* above-mentioned* are a proof, as they cannot well be formed during so thin a diet, and such frequent evacuations. It is therefore more probable, that they exist from the beginning of the disease, and are not expelled till after the tone of the intestines is sufficiently restored. Hence they are chiefly to be found in a convalescent state; tho' it often happens, that the coming away of these substances renews the irritation, and makes the *tenesmus* as bad as ever.

By a long continuance of the dysentery, the villous coat of the intestines is corroded, and the rest grow thicker by inflammation. Add to this, that when the ligaments of the *colon* give way, the *rugæ* and cells are lost, and the case ends in a lenteria or habitual *diarrhæa*.

The first blood probably oozes from the extremity of the *rectum*, where some small vessels are broke by straining; but afterwards,

* P. 216.

upon

upon the destruction of the villous coat, the hæmorrhage may come from any part of the *colon* or *rectum*, in a greater or smaller quantity, according to the size of the vessels. Now, the red globules being susceptible of a high degree of putrefaction*, if not speedily evacuated, may, as *Hoffman* well observes, considerably increase the disease.

The mortification of the bowels is generally preceded by a slow fever, occasioned by the absorption of the putrid matter; and this happens ofteneft when the air is infectious. At this period the distemper is most contagious, whether in producing a simple dysentery, or one combined with the common hospital-fever.

The putrid and contagious nature of the dysentery ranks it with the malignant or pestilential diseases. I have never seen cause to distinguish it into the *benign* and *malignant species*, as almost every case, when neglected, tends to a putrid fever, or mortification of the bowels. This, indeed, must be allowed, that such dysenteries as occur in the spring, are, like the fevers of that season, attended with more inflammation and less putrefaction; and that most cases, if taken at first, and properly managed, will have a favourable issue. But in general, such is the severity and obstinacy of the disease when once it is formed, that it can hardly ever be called *benign*.

* Append. Paper VII.

Lastly, as to the distinction some have made between the epidemic dysentery of the camp and that of other places, I must observe, that after perusing the accounts of several practitioners in towns, in various climates, I have found no material difference among them. For, if sometimes it is more fatal in armies than in cities, it is not so much from the extraordinary virulence, as from the want of necessaries; and from the pestilential nature, that all such distempers assume in foul and crowded hospitals.

§. 4.

Of the Cure of the Dysentery.

THERE are few acute disorders less beholden to nature for a cure, or attended with more deceitful indications. The hæmorrhage seems to require repeated bleedings and styptics; the flux, strong astringents; and the pains of the bowels, constant opiates: and yet unless these remedies are used with extreme caution, they tend more to augment than cure the disease. On the other hand, emetics and purges have formerly been either wholly condemned, or too sparingly used: yet later experience shews them to be the chief parts of the cure.

We may distinguish the dysentery into three states; *viz.* the first, when recent; the second,

second, when it has continued for some time, and has much impaired the strength, weakened the tone of the intestines, and abraded their villous coat; and the third, when either from the putrid *fomes* within the body, or the foul air of the hospital, a malignant fever is joined, and a mortification threatned.

In the first stage, it is proper to begin with bleeding; tho', at the same time, it may be true that a dysentery, of itself, does not require that evacuation*. But as this disorder is so often accompanied either with a *plethora*, or inflammatory symptoms, bleeding is frequently indispensable, and always conducive to the cure†. Yet unless the first blood is fizy, and the fever kept up by some extraordinary inflammation, repetitions are either needless or hurtful, as the strength is to be supported in so weakening and putrid a disease. From this rule we are to except winter or vernal dysenteries, as being of a more inflammatory nature.

After bleeding, the patient is to be vomited with *ipécacuanha*; which removes the sickness at stomach, so common in the beginning. We shall observe the emetic to be the more efficacious in proportion to the evacuation of bile; and that it succeeds best when it also operates by stool. Both these effects

* Dysenteria qua dysenteria venæsectionem nunquam indicat. BARBETTE Prax. Lib. IV. cap. v.

† Vid. BOTALL. de Curat. per Sang. Miss. Cap. iv.

were more certain, when instead of the usual quantity, five grains only were used, and repeated twice or thrice in the same day, till a vomiting or purging came on; which usually happened before, or soon after the third dose. Fifteen grains, given in this way, would generally evacuate more than thirty taken at once*. But, tho' I found this manner of giving the Root very successful, and especially when repeated once, or oftner, after a day's intermission, and that it was the least expensive course, yet, I laid it aside, on account of the great sickness that generally accompanied the operation: tho', upon

* PISO, who first described this root, and recommended it in the dysentery, appears to have relied on its purgative quality; tho' he adds, that it had still a better effect when it vomited also. Perhaps the medicine is more cathartic while fresh, than after long keeping; and better in decoction or infusion than in substance. We may likewise observe, that he recommends the second and third decoction for weak patients, as less cathartic and more astringent. I shall add one of his principal passages relating to the use of this specific. *Debine 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, & efficaciter tenacissimos quosdam humores per ipsam alvum, sæpissime autem per vomitum ejiciat, & a parte affecta derivet, vim quoque astringentem 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 ℥i. exhibetur. Postridie semel atque iterum pro re nata, secunda imo tertia ejus decoctio repetenda; tam quod ægri debiliores eam facilius ferant, quam quod astringentia ejus vis tunc magis efficax appareat.* GUL. PISON. Hist. Nat. & Med. Indiæ Occident. Lib. II. cap. ix.

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the whole, I am not yet clear, whether it is not the surest method of cure.

After repeated trials, I found the *vitrum ceratum antimonii* the most specific of all the emetics, not only in relieving the stomach, but also the bowels, if given in the beginning. But as the virtues of this medicine, with its dose and manner of operating, have been fully set forth elsewhere*, I shall omit them here; and only observe, that notwithstanding I was convinced of its being a powerful remedy, yet the operation being always rough, I could not avoid being anxious about the event, and wished to be able to cure the patient, tho' more slowly, yet with a milder remedy. Wherefore I confined its use to the more obstinate cases, and have observed it to succeed when other things have failed; if the bowels were tolerably sound, the patient but little feverish, and not too low. Another inconvenience attending this medicine, common to all antimonials, is the difficulty of making it to a standard. Hence it happens, that a moderate dose at one time, will be too little, or excessive at another. The improvement lately made upon it at *Paris*, by M. *Geoffroy*, may perhaps remove the objection†.

* Medical Essays, Vol. V. *Mem. de L'Acad. des Sciences A. 1745.*

† Loc. cit.

But,

But, whatever fault may be found with this preparation, there can be no harm in adding a grain or two of emetic tartar to a scruple of *ippecacuanha*; whereby the virtues of the Root will be retained, and the medicine rendered more purgative, and efficacious in evacuating the bile. For, having made several trials of this compound, I found it preferable here, as well as in the bilious fever, to the simple powder.

Next day after the vomit, the patient was purged with rhubarb; to which were joined a few grains of salt of wormwood. *Sydenham* adds other mild purgatives, to quicken the operation; which may be necessary, if this drug is not good, or too little of it given.

At all times we must attend less to the dose than to the effects, which are never to be judged of by the frequency, but the largeness of the stools, and the relief the patient finds from the gripes and *tenesmus* after the operation. The motions are generally more frequent from the disease alone, than from the purgative. As, on the one hand, the physician must avoid all the rough and stimulating purges, so, on the other, he is not to spare those of a lenient kind, especially the rhubarb, which is commonly underdosed. Of this, the sick may have, at first, from two scruples to a drachm*; and according as this shall work, the succeeding doses are to

* Vid. BARBETTE Prax. lib. iv. cap. v.

be proportioned. *Degnerus*, one of the best authors on this subject, advises to give this medicine in a watery tincture, in a small quantity, but to repeat it every four or six hours, and continue it for two or three days, or till the worst symptoms disappear*. As I have never tried this method, I cannot pretend to determine which of the two is best in a recent flux; but, in the advanced state, this seems preferable to the using larger doses at longer intervals. Which ever of the two ways is chosen, it is necessary the rhubarb should purge well; which it seldom does in the small quantities usually given.

In winter and vernal fluxes, I have found bleeding and rhubarb sufficient, without vomits: for, then the stomach is less disordered. At all times, whether the vomit is repeated or not, the purge must, either the next day or the day following; and afterwards as often as is consistent with the strength of the patient, or as the stubbornness of the case requires. We are to observe, that the necessity of continuing the physick, is to be determined more by the obstinacy of the gripes and *tenesmus*, than by blood in the stools. Without such frequent evacuations, it is in vain to attempt a cure; as all opiates and astringents only palliate, and render the disease more fatal in the end.

* *Hist. Dysent. cap. III. §. xxxvi. & seq.*

As to opiates, it were better they never were used at all, than given before the first passages are thoroughly cleansed. For, tho' they afford some ease, yet, by penning up the wind and corrupted humours, they fix the cause. This I presume to affirm from repeated experience; tho' Sydenham seems to apprehend little danger from them. Indeed, when the dysentery was most general, he did not omit purging; tho', at all other times, he seems to have trusted to *laudanum* alone*. But, whatever was the nature of his epidemics, I am well assured, that the fluxes incident to an army are of a less gentle nature, and never to be cured without evacuations. The best rule, therefore, is to withhold *opium* till the patient is both vomited and purged; and when it becomes necessary, to begin with small doses. I have generally used the *pil. Matthæi*†, or the following mixture.

R *aq. cinnamom. simp. unc. vij. aq cinna-*
mom. spir. unc. i. electar. e scord. cum
opio unc. sem. misc.

Of this the patient took a spoonful or two after every motion, on the days the rhubarb was intermitted; or at bed-time, after the operation of the physic, he used about seven grains of the pill. If these failed to give rest,

* De Morb. Acut. Sect. III. cap. iii.

† Pharm. Edinburgens.

it was a sign that some corrupted humours still remained in the bowels, and that it was more proper to go on with the evacuation, than to suppress the flux.

The warmer carminatives are so far from mitigating the gripes, and expelling the wind, that they rather tend to increase them. Next to opiates, I found nothing better for allaying the pains than fomenting the belly, and drinking chamemile-tea. Which last was first thought of, on account of its antispasmodic and bracing quality; but having since found it to be a powerful antiseptic, I am inclined to think that most of its effects were owing to that principle. The fomentations were made of common herbs, adding some spirits; but as they required frequent repetition, they were less adapted to the soldiers, than to the officers who were better attended. And for the same reason, mucilaginous and anodyne clysters were of less general use. When the pains of the belly were too fixed to yield to fomentations, they were relieved by a blister on the part affected; and sometimes I have used only a warm plaster, with a fourth or fifth part of the *emplastrum epispasticum* added to it. The flatulent pains would sometimes affect the side, as in a pleurisy; but rhubarb, fomentations, or such plasters, were the cure, without bleeding.

These are the chief rules to be observed in the first stage of the disease. But when ei-

ther by neglect or mismanagement, the flux has continued till the strength is much impaired, the intestines relaxed, and the villous coat abraded, the case becomes highly dangerous; tho' there are still hopes, as long as there are neither ichorous nor involuntary stools, *aphthæ*, *petechiæ*, nor a hiccup; and the patient does not complain of great lowness, and anxiety at the breast: for then the case is desperate, and even scarcely admits of palliatives; since opiates have little effect, either in easing the pain, or stopping the looseness. But when there is place for medicine, after taking away a little blood, omitting vomits, or using them cautiously, rhubarb and astringents are to be so intermixed, that at the same time the putrid humours are dislodged, the strength may be supported, and the intestines braced. For this purpose, those medicines are to be given alternately, till the gripes and *tenesmus* are removed. The proper astringent is either the mixture prescribed above, or this:

R extraēt. lign. Campech. dr. iij. solv. in aq. cinnamom. spir. unc. i. sem. add aq. fontan. unc. vij. tinēt. japonic. dr. ij. misc.

Of this last, let the patient take two spoonfuls, once in four or five hours. Sometimes one, and sometimes the other was used, according as an opiate was more or less wanted.

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In some cases the patient would seem likely to recover, but relapse upon voiding the hard *scybala* formerly mentioned* ; which coming away in small parcels, for several days together, make a constant irritation. These, therefore, are to be speedily evacuated, either by a full dose of rhubarb with *manna*, or by frequent oily clysters, which will have the same, or, perhaps, a better effect.

The dysentery, after a seeming cure, is apt to recur upon any cold, or error in diet ; so that, considering how incident both are to soldiers, a thorough recovery is not to be expected, if the convalescents return that season to the field. Again, we may observe, that tho' for the most part relapses are not attended with such acrimony as at first, yet, on the other hand, the intestines being once weakened, become more sensible of irritation. When relapses are apprehended, or the cure is imperfect, the person must still use a soft and mucilaginous diet, and continue to take some mild astringent, till his health be confirmed. This last intention has been answered by lime-water, given to a pint a day, and softened with half that quantity of boiled milk. Sometimes small doses of the Bark have been no less effectual, when joined to the extract of logwood, or the *tinctura japonica*. At other times I have found the following electuary to be useful, when the stomach could bear it.

* P. 228.

*R. conserv. rosar. unc. i. balsam. Locatell.
unc. sem. cum syrup. simp. q. s. f. electar.
Cap. bis terve die mol. nuc. moschat*.*

Some of the officers, upon their return to England, have had recourse to mineral waters, to perfect their recovery, but received little benefit from any. Those of *Shadwell*, which are very styptic, seem to answer best. Both with, or without these, we may give the following bitters.

*R. cortic. Peruvian. pulv. unc. i. rad. ser-
pentar. Virgin. contus. unc. sem. macera
per biduum in vin. rubr. Opport. lib. ij.
et col.
Cap. bis die cochl. iij. vel iv. cum tinct. Ja-
ponic. gutt. XL.*

As to diet, I followed the common practice, in confining the sick, in the beginning, to rice-gruel, panado, mutton-broth and the like; and gave for drink, rice or barley-water, or the white decoction. In the convalescent state, they were allowed meat; but no small-beer, and never any milk, unless diluted with lime-water: having observed, that milk by itself was apt to renew the gripes.

* The virtue of this medicine may be chiefly owing to the wax. *Vid. DIEMERBR. Obs. et Cur. Med. obs. xxviii.*

At first I used the chalk-julep, but being soon sensible of its bad effects, both in the beginning and low state of the disease, I left it off; tho' I could not then so well account for its disagreeing with the sick oftner than other astringents. But having since found by experiments, that both chalk and the *testacea* are of a septic nature*, it seems reasonable to reject them here; and the rather, as absorbents in general have been chiefly recommended in the dysentery, on a false supposition, that it arose from an acid†. Hence all acids were forbid; tho' considering the putrid nature of the disease, nothing could be more strongly indicated.

These, therefore, are to be given, but in so small a quantity as not to be too sharp for the bowels: a practice not only supported by *Degenerus*‡, but by *Dolæus*, another author of experience, and of such candour, that tho' he also refers the cause to an acid, yet strongly recommends a mixture of lemon-juice with oil, and says, that with that plain medicine he had cured above a hundred||. Agreeable to this method of sheathing the acid, we were told by a commander of the *Hussars* in the *German* campaign, that when his men, were seized with the dysentery, they put cream

* Append. Paper III. exp. xxiii.

† SYLVII. Prax. Append. Tract. X. sect. 206. 772.

‡ Vid. *Hist. dysent. cap. III. § lxxvii.* HOFFMAN in these cases recommends the use of *Rhenish* wine.

|| Encyclopæd. Med. Lib. III. cap. v. § xx.

and vinegar into separate vessels, and with two straws endeavoured to suck up equal portions of each at a time.

Pure air being of such consequence in the cure, the physician can scarce be successful in full hospitals, unless every ward is kept sweet by a ventilator. The next expedient is to lay the sick, if numerous, in churches, barns, or 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 highly conducive to the cure: but when warmth is incompatible with a purity of air, we must chiefly regard the latter. For the same reason, it is proper that such men as are not confined to their beds, should go out to ease themselves, tho' with some hazard of catching cold; and that the privies should be covered every day with fresh earth. It is also of great importance, that the nurses should keep every utensil within doors neat and clean.

The third state of the disease remains to be considered: but as this consists in a combination of the flux with a malignant fever, arising either from a putrid *fomes* within the body, or from the foul air of the house, it will be proper to refer it to the following chapter.

C H A P.

CHAP. VI.

*Observations on the MALIGNANT FEVER of
the HOSPITAL.*

I Come now to the most fatal distemper incident to an army, namely the hospital-fever. In treating of which, I shall, 1. describe its rise, and the manner of the infection. 2. The symptoms. 3. The prognostics. 4. The dissections of some who died of it. 5. The method of cure. And lastly, from these and other materials I shall enquire into the nature and causes of malignant fevers in general.

§: I.

Of the rise of the Hospital Fever, and the manner of the infection.

THE hospitals of an army, when crouded 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 very mortal*. I have observed the same sort arise in foul and crouded barracks; and in transport-ships, when filled beyond a due

* Vid. Part I. ch. ii. p. 15. Ch. iii. p. 22, 26, 27. Ch. vi. p. 40, 42, 46, 47, 52. Ch. viii. p. 69, 70. Part II. ch. ii. § iii.

number, and detained long by contrary winds ; or when the men were kept at sea, under close hatches in stormy weather*.

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 never seen ; and 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 disease is then incident to every place ill-aired and kept dirty, that is, exposed to putrid animal steams from foul or diseased bodies. And upon this account, jails and military hospitals are most obnoxious to this kind of pestilential infection ; as the first are in a constant state of filth and impurity, and the last are so much filled with the poisonous *effluvia* of sores, mortifications, dysenteric and other septic excrements. I have known instances of its beginning in the hospital, when there was no other cause but one of the men having a mortified limb. Nay, it is to be apprehended, that when a single

* I have seen here (at London) two cases of this fever, at different times in persons, who were taken ill at sea, or immediately upon landing, after a voyage from *Leith*, in bad weather with contrary winds, in ships crowded with passengers.

Hospital-ships for distant expeditions have been always destructive both to the sick and their attendants.

† Ch. vi. p. 46.

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. This I have known to happen in camp, when any has been seized with such a disorder, and kept his tent too close. But, excepting a few occurrences of this kind, this fever is properly none of the camp-diseases, tho' it be universally accounted such; for, being frequently seen in camp-hospitals, it is therefore supposed to come from the field.

I have seen 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 it is not particularly virulent, or when a person has not breathed long in such dangerous steams, he will either escape, or have the symptoms come on so slowly, as there will be time for prevention, before the fever is quite formed. Much will also depend on the constitution; sometimes one will have the disorder hanging about him for several days before it confines him to his bed; others I have known complain for weeks of the same symptoms, without any regular fever: and others,

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after

after leaving the infectious place, without a fever, have afterwards been seized therewith*.

§. 2.

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 greatest at night, the body is hot, the sleep interrupted and not refreshing. With these symptoms there is some pain or confusion of the head, but never violent. The pulse is at first little quicker than natural; the tongue is white; but the drought is inconsiderable. Those who are thus affected find themselves too much indisposed to go about business, but too well to be altogether confined. In this state, sometimes a change of air will remove the disorder, sometimes a sweat. I have had experience of both methods of preservation in my own case. What may seem particular, I have more than once known a large bleeding, while the person was going about with these symptoms, instead of relieving the head, immediately sink the pulse and bring on a *delirium*.

* Vid. Part I. ch. vi. p. 46. & seq.

Except

Except by this last mark, and the *tremor* of the hands, the disease is not easily to be distinguished, in the beginning, from any common fever*. The diagnostics must then be taken from other circumstances. We are therefore to enquire if the person has been exposed to the usual causes of fevers, or to foul air and infection; again, whether he is relieved by bleeding or not: because, in inflammatory fevers, bleeding constantly moderates all the symptoms, but in this it seldom gives ease.

When the fever advances fast, the symptoms already mentioned are all in a higher degree; and to these are added, great lassitude, a *nausea*, pains in the back, a more constant pain and confusion in the head, a dejection of spirits, and an uncommon *tremor* of the hands. At this time the pulse is never sunk, but beats quick, and often varies in the same day as to strength and fullness. The first bleeding, if moderate, affects the pulse little; 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 eva-

* Febres malignas in principio statim cognoscere difficile est, cum malignitas sæpe diu lateat, et non nisi ubi vires sumit sese prodant. SENNERT. Epit. de Febr. Lib. IV. cap. x.

cuations, the pulse, sooner or later, sinks, and gives then certain indication of the malignity of the disease.

The blood has been found so various, that it is impossible to predict what will be its appearance; for, tho' commonly it is little altered, it has been seen fizy, not only upon the first attack, but after the fever was well formed. The worst kind is when the *crassamentum* is resolved, but this does not happen till the disease has continued for several days; and then it is a sign of high putrefaction.

The urine seldom discovers great marks of fever; sometimes it is of a reddish or flame-colour, which it preserves a long time; but is oftner pale, and varies from day to day 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 deposite a sediment.

If the sick lie warm, and have had no preceding flux, the body is generally costive; 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 then critical. In the worst cases a flux appears in the last stage; when the stools are involuntary, colliquative, ichorous, or bloody, and of 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

the nurses will be infected with the flux only, and others with the malignant fever, ending in these bloody and gangrænous stools.

In the beginning the heat is moderate; and even in the advanced state, in bad cases, on first touching the skin, it seems inconsiderable, or even below natural; but then upon feeling the pulse for sometime together, I have been sensible of an uncommon ardour, leaving an unpleasant sensation on my fingers for some minutes afterwards*. 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 the testimony of others, who, without knowing of my observation, had made the same remark. A day or two before death, the extremities become quite cold, and then the pulse is hardly to be felt.

The skin is generally dry and parched, tho' sometimes there are shorter or longer sweats, especially in the beginning. Those produced by medicine are of no use but 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

* 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 erodere tactum videtur* — *Non statim ea qualitas, adnota manu, discernitur, at per moram prædicta caliditatis species effertur ex penitioribus partibus.* LACUN. Epit. GALEN. de differ. Febr. Lib. I. cap. vii.

decline.

decline. These are rarely profuse, as in other fevers, but gentle, continued and diffused equally over the body: and sometimes the disease will terminate by an almost imperceptible moisture of the skin. The sweats are usually fetid, and sometimes even offensive to the patient himself.

The tongue is mostly dry, and without constant care of the nurse, becomes hard and black, with deep chops: but this symptom is common to most fevers. What may be particular to this is, that sometimes the tongue will be soft and moist to the last, but with a mixture of a green or yellow colour. The drought is sometimes great, oftner moderate. In the advanced state the breath is always offensive.

Some are never delirious, but all are under a great *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 than a feverish look. The face is late in acquiring either a ghastly or 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 with an unseasonable hot *regimen*, seldom turns to rage, or to those high flights
of

of imagination frequent in other fevers. When the *delirium* is at its height, the face is flushed, the eyes are very red, the voice becomes quick, and the patient struggles to get up. But when that disorder is owing to large evacuations, or otherwise in 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 always a great dejection of mind, and failure of strength.

It is more common to have a *tremor* than a *subfultus tendinum*, or if that symptom occurs, it is in a lesser degree than in many other fevers. All along as the pulse sinks, the *delirium* and *tremor* increase; and in proportion to its rising, the head and spirits are relieved. Frequently, from the very beginning, the patient grows dull of hearing, and at last 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, or so medicinal as wine. They long for no food, yet take willingly a little panado, if wine is added. But such as are delirious, with a quick voice, wild looks, a *subfultus tendinum*, or violent actions, bear neither hot medicines, wine, nor the common cordials.

Vomiting,

Vomiting, and complaints of a load and sickness at the stomach, tho' usual symptoms, are not essential to the disease: neither are pleuritic stitches, difficulty in breathing, or flying pains, so much to be ascribed to it, as to the constitution of the patient, or a preceding cold.

There are certain spots, which are the frequent, but not inseparable attendants of the fever. These are the true *petechiæ**, being sometimes of a brighter or paler red, at other times of a livid colour; but are never raised above the skin†. They are small, and commonly distinct, but sometimes so confluent, that at a little distance the skin looks only somewhat redder than ordinary, as if the colour was uniform; but upon a nearer inspection the interstices are seen. For the most part these spots are so little conspicuous, that unless look'd for attentively, they may escape notice. They come thickest out on the breast and back, less on the legs and arms, and I do not remember of having

* These spots, and the fever they accompany, were as far as I know, first distinctly described by FRACASTORIUS, and called *Lenticulæ* or *Puncticula*. *Vid. de Morb. Contag. Lib. II. cap. vi. vii.* In his time they also went by the name of *Peticulæ*, but have since been universally called *Petechiæ*, both Italian words latinized.

† For this reason they are not to be referred to any of the *ecthymata* of the antients, which denote pustles or eruptions higher than the skin, as in miliary fevers, with which this malignant fever is not to be confounded.

seen any upon the face*. They sometimes appear as early as the fourth or fifth day, and at other times as late as the fourteenth. They are never critical, nor are they to be reckoned among the mortal signs; but only to concur with other circumstances to ascertain the malignity. The nearer they approach to a purple, the more ominous they are. In a few cases, instead of spots, I have observed purple streaks and blotches, which perhaps are more to be dreaded. But these spots and *vibices* will sometimes not come out till after death†; and we had a case in the hospital, when, upon bleeding, the *petechiæ* were seen on the arm, below the ligature, and nowhere else on the body.

This fever, tho' of the continued kind, has often exacerbations at night, with remissions and partial sweats next day: and after a long continuance, is apt to change into a hectic, a remitting or intermitting form.

The length of the fever is uncertain, the time, as in the plague, depending upon the malignity: for, in proportion to its virulence the course is quicker. In the hospitals we

* Dr. CLEPHANE lately told me, that he remembers well that one of the men, sent from the cantonements to *Oosterhout* in the year 1748, had large Petechial spots all over his cheeks. The faintness of the colour, with their appearing so seldom on the face, seems to be the reason of their having been overlooked altogether, or but slightly mentioned by the antients.

† A circumstance incident to the plague. Vid. DIEMERBROEK de Peste. Lib. iv. hist. v.

have

have had it generally running from fourteen to twenty days*: but some have 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 often terminates in suppurations of the parotid‡, or axillary glands; and when those do not appear, it is probable the distemper is kept up by the formation of some internal abscess. Many, upon coming out of the fever, complain of a pain in their limbs, and want of rest; and almost all of great weakness, confusion in their head, *vertigo* and noise in their ears. When the air is at the highest pitch of malignity, the course of the disease becomes very rapid, so as to terminate in five or six days, either in death, or recovery.

* 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 remarked, as we are not to expect to bring on a proper *crisis* before that time.

† That is, beyond 16 or 17 days.

‡ I remember one instance of both parotids swelling, without any previous indisposition; when the person, not suspecting the cause, and applying discutient cataplasms, was immediately, upon the tumours subsiding, seized with the malignant fever. This happened to Mr. DUNCAN FORBES, surgeon in town, then a mate in the hospital.

Having

Having now described the most distinguishing marks of this fever, I shall only add, that there are certain low degrees of it hardly to be characterized; and which can only be discovered in full hospitals, by observing men languish, tho' the nature of the illness, for which they came in should seem to admit of a speedier cure. In such cases, the only marks are slight head-achs, a whitish tongue, want of appetite, and other inconsiderable feverish symptoms.

§. 3.

Of the Prognostics.

MEN who have been weakened by other distempers, or by cures (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 kind may be, and however well they may get through the two first stages of that disease, fall readily into this fever and die. One who has recovered is no 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 relapses as others. The second fever is attended with double danger, as the patient has been so much weakened

by the first. Women seem more susceptible of the infection than men ; but, when taken ill, escape better : which is probably owing to the laxity of their skin, more favourable to a sweat. A sure sign of the corruption of the air in an hospital, is when many of the nurses fall sick.

From no sign by itself are we to draw any prognostic, and all of them together are more fallible in malignant 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. It seems peculiar to malignant fevers, that deafness is rather a good sign. A sediment in the urine, without other changes to the better, is no sure mark of recovery ; and some recover without it.

The bad signs, are a *subsultus tendinum* ; eyes much inflamed and staring ; the speech quick, and the sound of the voice altered ; high *delirium* ; constant watchfulness ; vomitings ; frequent stools, with a sinking pulse, and the disorder of the head encreased ; 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 cannot lie but upon his back, 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 an indication 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 a fever begins, a long continuance of it corrupts the humours, and affects the brain and nerves, much in the same manner as do those which arise from infection.

§. 4.

Of the Dissections.

Hitherto we have examined the state of the living body, we shall next consider its appearance after death, and see how far by dissections, we may advance in the knowledge of its nature and cure. For, tho' we have been but little successful in this re-
S search,

search, it will still be satisfactory to think that it has not been wholly neglected*.

The dissections of those who died of the common hospital-fever, or of *Houghton's* regiment, which had the distemper from the jails, have been 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 of our enquiry, I thought proper to mention, that if any thing farther was to be learned from dissection, what was here done might not be considered as complete, or prevent others from pursuing the point farther.

The most unexpected appearance after death, were abscesses of the brain, which I shall therefore more particularly mention. The first I saw of this kind was at *Ghent*; but the man being brought into the hospital from the barracks, only two days before he died, from the symptoms and account I had of his disease, I could only conjecture, that his death was owing either to this fever, or to one of a low or nervous kind, after lingering near a month in it. I found about three ounces of purulent matter in the ventricles of

* I found it the more necessary to make these dissections, as I had met with no author that gave sufficient light into this matter. For, tho' *BONERUS* has diligently collected many cases of those said to have died of malignant fevers, yet they were not to be relied upon; for as much as the malignity was disputable in many of them, and that in others the head was not opened.

the brain, and observed that the whole cortical and medullary substance was extremely flaccid and tender. What was more extraordinary, I discovered some of the same kind of matter in the substance of the *cerebellum*, upon the upper part: yet, this person, with some *stupor* and deafness, had his senses till the night before he died, so entire, that he answered distinctly when spoke 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 very early. 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 he died, he would taste nothing but cold water. During his illness he lay on his right side. The head being opened, an abscess as big as an egg was found in the substance of the forepart of the right hemisphere of the brain, full of a thin matter like whey. At that time, five more, ill of the same fever, had the like swelling of their heads, but recovered*. This extraor-

* This happened at *Liverness*, and all or most of the men were of *Houghton's* regiment. Vid. p. 43.

dinary symptom I never observed before nor since. In the other case, the abscess in the *cerebellum* was about the size of a small pidgeon's egg, containing also a thin ichorous matter. Nor had this patient been ever so thoroughly insensible, as not to answer reasonably when spoke to. Two days before death, his urine turned very pale. Both these bodies were opened by Mr. *Breach*, apothecary in *Southwark*, then 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 under-side of the liver was beginning to mortify, the large guts were already corrupted, and the smaller much inflamed. This man went off with a looseness, and just before his death had a discharge of an ichorous matter from his nose. In the military hospital at *Ipswich*, one dying of this fever unexpectedly, after having been once in a fair way, had no suppuration in his brain. And about the same time, Dr. *Clephane* told me, he had seen the head of one opened, who died after an abscess formed in each of the orbits; that he found the brain very flaccid, and about two ounces

of a thin *serum* in the ventricles : but neither of these two bodies were farther inspected.

I shall not enter into a description of other particulars in these dissections ; for, tho' I have them written at length, it may be sufficient here, from what has been said, to draw the following conclusions.

That, as there is the greatest tendency to putrefaction through the whole course of the disease, so it always 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 subject to mortify, few dying without cadaverous and involuntary stools. And, by an observation we have made of the *petechiæ* not appearing till after death, it seems reasonable to conclude, that these are always owing to a resolution and corruption of the blood. The putrid sweats and smell of the body before death, are a farther argument for what has been advanced. That, 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 abscesses are not rare occurrences in this fever*.

* From the numerous dissections of those who died of the last plague at *Marseilles*, it appeared, that always some of the *viscera* were inflamed and mortified, and that the brain and lungs were most frequently affected in this manner. *Vid. Traité de la Peste, Part I.*

From the inflammatory appearance of the brain without suppuration, we may account for the same remedies having sometimes in this fever quite opposite effects. For, tho' in the advanced state, the warm and spirituous medicines are often the best, yet there are some who cannot take them without increasing the *delirium*; such, therefore, probably have some inflammation about the brain, as in a common fever.

The last observation I shall make upon the occasion of dissection is, that the great tendency of this fever to putrefaction, reduces it to the pestilential class; all of which kind being remarkable for a prostration of strength, sunk pulse, dejection of spirits, putrid sweats and stools, *petechiæ*, livid blotches, and the like symptoms.

These are all the inferences we may safely draw from the dissection of the bodies. But from such materials to ascertain the first morbid matter, where the effects only are seen, or from thence to account for all the varieties of this fever, would be too great an attempt. Nor would it be just to propose our method of cure, as deduced from the inspection of dead bodies, since the most successful part of it has been taken from the experience of others, or trials of my own, preceding most of these dissections.

§. 5.

Of the Cure.

IN the cure of this fever, as in all others, we must vary our method according to its state. I shall, therefore, distinguish it into three periods, and in each, propose those remedies which I have found by experience 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 apparent, the head much affected, but the pulse still full; and the third, when the pulse sinks, and a *stupor* comes on, with other symptoms already described.

I. In the first period, 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, whilst the air continues in this corrupted state, or indeed increases in it by the *effluvia* of the diseased, there can be little hope of a cure. Wherefore, in every stage, tho' the patient can breathe no other infectious air, but that of his own atmosphere, it will be necessary

to keep the curtains undrawn, and use all other means to procure a free ventilation. On the strict observation of this rule the cure will in a great measure depend.

For the next article of prevention, I have sometimes given a vomit, and after the operation, a moderate *bolus* of *theriaca*, with ten grains of *sal cornu cervi*, and some draughts of vinegar whey; and repeated the same without the vomit the next night. At other times I have used the sudorifics alone, and by both methods I have generally seen those complaints removed, which I apprehended were the forerunners of this fever received by contagion. But previous to the vomits or sweats, if the person is plethoric, it will be necessary to take away some blood.

I must not omit what may appear a minute circumstance, that as, not only now, but afterwards, the cure depends so much upon a free *diaphoresis*, it will be found 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, the *alexipharmac* decoction I shall treat of afterwards.

II. But, in the second stage, when the fever is manifest, with a quick and full pulse, it will be proper to begin with a small or moderate bleeding. When the symptoms are high,

high, a plentiful evacuation seems indicated; yet large bleedings have generally proved fatal, by sinking the pulse and bringing on a *delirium*. Nor is a moderate bleeding to be repeated, but with the utmost caution; for, as many things here are contradictory to the common rules, so experience shews, that even those whose blood is fizy, unless the lungs are inflamed, are generally the worse for a second bleeding. If only the head suffers, it will be 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 do no good, sometimes harm; and phlebotomy is pernicious. Many have recovered without bleeding, but few who have lost much blood*.

Vomits are also to be used cautiously. Before the disease is formed, one is recommended for prevention; and even if the stomach has been foul, as is most usual in autumn, a gentle emetic is also proper in the beginning of the second period, as it may relieve the

* Altho' it is probable, that all malignant fevers arise from some putrid *miasma* received from without, or generated within the body, yet I am far from thinking, that they are all to be treated in this manner. For, the remitting fever of the camp and the ardent fever of the marshes often demanded repeated bleeding; and yet both proceeded from a septic cause. Of the same kind was that malignant fever described by DIEMERBROEK, which beginning in the camp, infected the inhabitants of *Nimeguen*, and was not to be cured without large and frequent bleedings. *Vid. Observat. & Curat. Med. Obs. xxiv.*

stomach,

stomach, and dispose more to a sweat. But when the fever is fixed, and a vomiting supervenes, which is always a bad symptom, an emetic may then be dangerous. At most, some draughts of chamemile-tea, or the like, are to be given, and afterwards the saline mixture*, and if necessary, a laxative clyster, to determine the humours downwards.

The next care is to promote a *diaphoresis*; but in this state of the fever it is only to be attempted by the milder sudorifics: and for this purpose the *spiritus Mindereri* seems to be the best. But at this time of the disease it generally happens, that the morbid cause is too much fixed to be expelled by sweating; and, therefore, unless that comes easily and with relief to the patient, it is never to be forced or insisted on; and even if voluntary and profuse, with a low and quick pulse, it must be checked. Then the fever begins to elude all the force of blisters, alexipharmacs and sudorifics, until the usual time of its decline. Of this I have seen many instances, but shall mention one only. Mr. Annesly, one of the mates, was seized with

* *Huic symptomati (scil. vomitui) gravissimo statim medetur, quasi miraculo, Sal Absinthii ad ʒi. 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 Append. Paper VII. exp. xlv. I find the quantity of a drachm of the salt in the above mixture marked in two editions of the original, yet I doubt it is a mistake in the printer, for a scruple; but I would not alter it.

the hospital-fever, and after being confined to his bed for four or five days, and blistered, he took several doses of musk, each containing twenty-five grains, which opened the body, raised the pulse, and brought on a thorough sweat; yet the fever continued till about the seventeenth day, when it went off with a moisture of the skin and turbid urine.

As soon, therefore, as it appears that the distemper is confirmed, it will be proper to give such medicines only as were recommended before in the cure of inflammatory fevers*; viz. the *contrayerva* powders, with nitre and camphire, and the common ptisan acidulated†.

Tho

* Part III. ch. i. p.

† Almost all authors agree in recommending acids in the cure of malignant fevers: and I have also followed that practice; that is, the ptisan was acidulated with the spirit of vitriol, and some were allowed to eat a slice of an orange, which moistened the tongue and proved grateful and refreshing.

MINDERERUS, DIEMERBROEK, and others have praised vinegar, but which was not sufficiently tried in the advanced state of our fevers. For then I trusted chiefly to wine; in the daily allowance of which, I presumed there might be contained as much of an antiseptic quality as in any quantity I could give of vinegar, in the same time, without offending the stomach. This seems to be the proper distinction between the virtues of the two; wine is most to be relied on, when it can be given without encreasing the *delirium*; otherwise, vinegar or mineral acids only are to be used. But, with regard to antiseptics in general, it may be remarked, that tho' they are necessary for preventing the high degree of putrefaction, yet after the fever is once formed, we must not expect to shorten it by any medicine of that kind; as such have no power to remove those obstructions, which are found so soon to take place in this disease. Dr. WARREN is the only author, that I remember,

Tho' costiveness is to be prevented by emollient clysters, (lest an accumulation of the *faeces* prove a new *fomes* of corruption) yet this evacuation is not to be repeated so often as in inflammatory fevers, on account of the weakness attending this disease.

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 it, or preventing any of the usual symptoms.

Opiates are dangerous in this state, and unsafe in the following; for, no good is to be expected from a sweat, and if they fail in bringing that out, they are sure to increase the *delirium*.

III. We come now to the third and longest period, in which the pulse sinks, the *stupor* is greater, a *delirium* impends, and *petechiae* 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, on the first complaints, has been once or twice largely blood-ed, he will be apt to pass over the second member, who cautions against the too free use of acids in a malignant fever. See his treatise upon that of *Barbadoes*, p. 44. The reason why we cannot depend upon antiseptics alone, for a cure, may be drawn from what shall be said towards the end of the last section of this chapter.

stage;

stage ; and from a condition little removed from health, his pulse sinking, he may at once become delirious. Now, whether by misconduct, or the course of the disease this alteration happens, we must vary the method, and have for our principal intention the support of the *vis vitæ*, especially towards the decline of the fever : but which cannot be done without warmer medicines than what have yet been proposed. Wherefore, as soon as the pulse begins to flag, and the urine to turn pale, we are to leave out the nitre in the diaphoretic powders or mixture*, and replace it with the *serpentaria*.

Sometimes I have given a plain decoction of that root, adding a small quantity of a strong water ; at other times, I have prescribed the same medicine in substance, from two to four scruples a day, with sensible good effects : but in the last campaign, an accident gave the hint of adding the Bark. A man ill of this fever, with petechial spots, had a blister applied to his back, and the part mortified. The case seemed desperate, 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 to take so favourable a turn, that there was little doubt of the patient's recovery ; till nauseating the

* See Part III. ch. i. p. 135.

medicine,

medicine, he left it off, whereupon the gangrene recurred, and he died. From hence, however, I was induced to join the Bark in decoction with the snake-root, and give it in the advanced and sunk state of the fever. The first nine recovered who had this compound medicine, tho' four of them had the *petechiæ*, the rest a lesser degree of the distemper. And in thirty-nine cases, that were under my care 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 so much malignity as I have seen it at other times. For, at *Ipswich*, where the kind was worse, and where the air was so much vitiated in the hospital, that almost all the nurses were infected, as well as the men, who were admitted for other distempers, I reckon (for I kept no exact account) that I might lose about double that proportion.

When I first joined the Bark to the *serpentaria* in ordinary cases, I began with a much smaller quantity than was used in that of the gangrene, intending to increase it by degrees; but finding what was then given answer so well, I never altered it. This is the receipt:

R. rad. *serpentar. Virgin. contus. cortic. Peruvian. pulv. aa. dr. iij. coq. in aq. fontan.*

fontan. lib. i. ad dimid. colaturæ add.
aq. cinnamom. spir. unc. 5. sem. syrup. e
*cortic. aurant. dr. ij. * misc.*
Cap. quarta vel sexta quaque hora cochl. iv.

By means of this decoction, not only the *vis vitæ* was supported, but a *diaphoresis* promoted at the *crisis*. Even after the recess of the fever, the same medicine being continued in a smaller quantity, not only served as a strengthener, but likewise as a preservative against a relapse, whilst the patient remained in the hospital. 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. I need only add, that tho' I gave the snake-root as soon as the pulse began to fail, I never joined the Bark to it, till towards the decline of the disease, when the pulse was low, the voice slow and weak, the head affected with a *stupor*, but with little *delirium*.

To this medicine it was necessary to subjoin a cordial, consisting of the common ingredients, but with a larger dose than ordinary of the *sal cornu cervi*, of which the patients commonly had to the amount of half a drachm a day. But in cases out of the hospital, and where there was no restriction as to

* It was observed that this small proportion of a syrup rendered the taste of the decoction less disagreeable, and that a larger quantity made it more nauseous.

the quantity of wine, I either omitted this cordial, 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, was the best resource.

But, for a grateful cordial in this state, there was nothing comparable to wine*, whereof

* It has been a great debate among authors, whether wine was to be given in malignant and pestilential fevers or not; some condemning it altogether, and others recommending it as universally. *ARETÆUS*, in treating of the *syncope*, or low state of the ardent fever (a putrid disease), makes a prudent distinction, shews when it is proper and when hurtful, and sometimes prescribes it in a large quantity. *Vid. Lib. III. cap. iii. de Curat. Acut. Morb.*

Agreeable to this is an observation of *RIVERIUS*; (an author of great experience in these fevers) which, as so nearly relating to a subject we are now treating of, I shall transcribe at length: *Circa potum hoc etiam adnotandum, vini usum in hac febre (scil. pestilentiali) aliquando esse proficuum, utpote in signe cardiacum, & malignæ qualitati maxime adversum.—Hæc a nobis observata sunt infinitis experimentis, ac præsertim in febre purpurata, quæ Monspeliæ grossata est anno 1623, post urbis observationem, quæ tantæ malignitatis particeps fuit, ut tertia ad minus ægrotantium pars de medio sublata fuerit, et a vera peste solo bubone distincta fuerit: cum non solum ecchymata & exanthemata rubra, livida & nigra, sed etiam carbunculi & parotides frequenter apparerent.—Iis enim ægrotantibus, quibus pulsus erat parum frequens, & pulsus sanorum fere similis, lingua humida & nulla sitis, vinum exhibuimus felici successu; illius continuationem indicabat levamen inde emergens—Iis vero quibus febris erat intensior, cum siti, linguæ siccitate, scabritie aut nigredine, vinum prorsus interdicebamus, eosque in refrigerantium acidulorumque potuum usu perpetuo detinebamus. Advertendum tamen est primis morbi diebus vinum nunquam esse adhibendum, ne materia nimium exagitentur; sed tantum circa statum, cum malignitatis signa sese magis exerere incipiunt. *Vid. cap. de Feb. Pestilent.**

POTE-

whereof the common men had an allowance to half a pint a day, of a strong kind, made

POTERIUS and THOMAS BARTHOLINE are more general in recommending wine: for the first, he only says, *In malignis febribus, atque in ipso contagio vinum esse tutum agnoscimus. De Feb. Lib. II. cap. xxviii.* And the latter, relating the case of a man, (who being given over in a petechial fever, drank a large quantity of *Rhenish* wine, and thereupon falling into a sweat, recovered) concludes with these words: *Similia exempla plura apud nos memoriae occurrunt. Histor. Anat. et Med. Rar. Cent. VI. hist. vii.*

To these might be joined other authorities from writers of note; but I shall only insert the following, from the celebrated HOFFMAN. *In febribus malignis vino (scil. Rhenano vel hujusmodi alio) nil datur excellentius: malignitas dignoscitur ex motuum et virtutum defectu, nec non valde depressa sanguinis spiritusascensio, ex tardo circulo ejusdem, quæ cuncta dispositionem quandam cruoris ad putredinem designant. Igitur in iis morbis restaurare vires, spiritus erigere, circulum sanguinis liberum reddere, transpirationem movere expedit; et in eo versatur omnis alexipharmacorum virtus. Quod vinum hæc omnia præstet, nolumus pluribus auctoritatibus, quibus practitorum libri pleni sunt confirmare, sed confugimus ad solam experientiam, qua nobis constat, plures ex malignis evasisse solius vini moderato usu. Dissert. de Vin. Rhenan. Præstant. Cap. vi. §. xiii.*

It may be observed, that both RIVERIUS and HOFFMAN are cautious about giving wine, unless with a slow pulse; if so we may interpret the *pulsus parum frequens* of the former, and the *tardus circulus* of the latter: but I must add, from my own experience, that in our malignant fever, when the pulse sunk, it became always very frequent, and in proportion as it rose with wine, it turned slower; and that I have also had experience of the good effects of wine when the tongue has been both foul and dry. The surest indication for wine is taken from the long continuance of the disease, the *languor*, dejection of strength, the slowness and faintness of the voice: but we can never be absolutely certain of its effects till we try them. I have seen, in cases of this kind, strange instances of the power of instinct; for, when wine was to do good, the sick swallowed it greedily and asked for more; when it was to heat them, or raise the *delirium*, they either shewed an indifference or aversion to it. Sometimes the physician can have no better measure for the quantity requisite, than the appetite of his patient.

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into

into whey, or added to the panado, which was their only food. But to others out of the hospital, I commonly prescribed *Rhenish*, or a small *French* wine, of which some have consumed near a quart a day, and part of that undiluted. And, indeed, so great is the virtue of wine in this state of the fever, that I have known many recover from the lowest condition, when refusing the decoction, on account of its taste, they took nothing but a little panado with wine, and the volatile mixture, every two or three hours, by turns. Perhaps there is no rule of more importance, than to give strict charge to the attendants of the sick, never to let the patient, when low, remain longer without taking something cordial or nourishing; having seen men, once in a promising condition, sunk past recovery, by being allowed to pass a whole night without any support, about the time of the *crisis*. Nothing can be supposed lower than the sick are in the advanced state of this fever; and therefore *Hoffman* rightly advises, in all such cases, to keep them constantly in bed, and not to permit them even to sit up in it. In the last stage of this disease, as well as in that of the sea-scurvy, it would appear, that the force of the heat was too small to convey the blood to the brain, unless in a horizontal posture*.

* See the description of the sea-scurvy in Lord ANSON'S voyage.

But however necessary wine, volatiles and other cordials are in the low state of the fever, we are to remember, that throughout this long stage, these medicines are only to be administered by way of antiseptics, and for supporting the *vis vitæ*; without aiming at raising the pulse, relieving the head, forcing a sweat, or any other discharge, before nature points that way: and which seldom happens before the 15th or 16th day, after the patient is confined to his bed. For, tho' either immoderate bleeding at first, or the too free use of hot things (especially opiates) afterwards, may occasion death before that period, yet, so far as I have observed, no medicine is powerful enough to bring on a favourable *crisis* sooner. This I shall endeavour to account for towards the end of the next section.

We have seen how inseparable a *stupor* was from this fever, particularly in its low state; and how apt this, in the evening, was to turn to a slight *delirium*. If this is all, as being in the common course, nothing need be done. But if the *delirium* increales upon using wine, if the eyes look wild, or the voice becomes quick, there is a presumption of a true *phrenitis*. And agreeably to this, I have observed, that at such times, all internal heating medicines aggravated the symptoms; whilst blisters, before useless, became then of considerable service. Wherefore, in

this emergency, the epispastics are to be used as in inflammatory fevers; and when the pulse is most sunk, recourse is likewise to be had to the sinapisms formerly mentioned*. As camphire is the best internal medicine, we are to give the mixture as before, keeping to smaller quantities of the snake-root†, but increasing the camphire if the stomach will bear it. Having observed how a *delirium* would arise from two opposite errors; one, from large and repeated bleedings; and the other, from giving wine and the warm cordial medicines too early; it appears from hence how limited the principles are that regard the cure. Thus, neither a hot, nor a cool regimen answers with every patient, nor with every state of the disease.

If a *diarrhœa* comes on in the decline of the fever, it is to be moderated (but never suppressed) by adding a few drops of the *tinctura Thebaïca*, to the full quantity of the alexipharmac decoction; or by giving a spoonful or two of the astringent mixture

* Part III. ch. i. p. 134. Such kind of applications to the soles of the feet have been called *cataplasmata CRATONIS*, from the author, who, compounding them of horse-radish, salt and vinegar, first introduced them in the cure of pestilential fevers. Both these and blisters are much recommended by RIVERIUS, from experience, in cases of this nature. *Vid. cap. de Febr. Pestilent.*

† In such cases I rarely exceeded a scruple of this medicine, given in substance in four and twenty hours; tho' I have not been sensible of its being of so hot a nature as to heighten the *delirium*. The mixture is mentioned p. 135. 269.

mentioned

mentioned before*. For, tho' the looseness may be considered as critical, yet as the sick are too low to bear great evacuations, it must be somewhat 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, that carried off the disease. In the worst kinds of the fever, and especially when it coincides with the dysentery, the stools are frequently bloody; in which dangerous case, if any thing can be done, we must attempt it by the same medicines. In proportion to the putrid nature of the stools, astringents are to be used with the more caution.

We shall next consider the state of the patient after the fever is over, or changed into another shape. If the disease terminates in a suppuration of the parotid glands, one caution only is needful; namely, to open the abscess, as soon as it can be supposed to have formed matter; without waiting for a fluctuation, or even a softness of the tumour, that may never happen: the *pus* being here so very viscid, that after it is ripe, the part will feel as hard as if the suppuration had not begun†.

* Part III. ch. v. §. 4. p. 236.

† This may be the reason why these tumours have not always been found 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.*

Almost all, when the fever is over, complain of want of rest, frequently of a *vertigo*, a confusion of the head, with a continuation of the deafness, and other nervous symptoms, sometimes the consequence of great lowness, and at other times of some disorder not so easily to be accounted for. The remedies are the *pilula Matthæi* at night, with analeptics, and medicines of the strengthening kind. When the pulse is slow, a few grains of *asa fetida* given twice a day, have a good effect. But if there is any appearance of a hectic fever, from an inward abscess, the case is to be treated accordingly. Upon comparing some of the remaining symptoms of those that recovered, with the condition of the brain in such as died, I have been induced to think, that some part even of this substance might suppurate, and yet the patient recover.

Sometimes the person falls into an irregular intermittent, which (if not hectic from an internal abscess) may proceed from neglecting to cleanse the *primæ viæ*. For, it is easily conceived, that after a long fever of a putrid nature, attended with a *languor* of the bowels, the *fæces* may be so much accumulated, as to occasion various disorders. But in such cases, after proper evacuation, the Bark is almost a sure remedy.

§. 6.

*Of the Nature and Causes of malignant Fevers
in general.*

IT is evident from the preceding account, that this distemper is of a truly malignant or pestilential nature; as appears by the manner in which the head is affected, the dejection of spirits, debility, sunk pulse, the suppuration of the parotid and axillary glands, the putrid sweats, petechial spots, mortifications, and contagion. For, tho' 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 constitution of the person infected.

It will be unnecessary to shew the difference between a malignant or pestilential fever, and the true plague; as that distinction, not clearly apprehended by the antients, has been well ascertained by some of the best later writers on that subject*. And therefore I shall only remark, that tho' the hospital-fever may differ *in specie* from the true plague, yet it may be accounted of the same

* FRACASTORIUS, MINDERERUS, SENNERTUS, BAR-
ETTE, DIEMERBROEK, RIVERIUS, MEAD.

genus; seeing it proceeds from a similar cause, and is attended with the like symptoms.

The malignant or pestilential fevers are various, according to the virulence of the *miasma*, or putrid ferment received into the blood; but all depend upon some internal or external *fomes* of corruption, whether owing to a scorbutic habit, or to exhalations from putrid animal, or vegetable substances. I shall first treat of the external cause, and next of the internal.

I. THE hospital and jail-fevers 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 eye-witness 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

* Epit. *GALEN*. de Feb. Differ. Lib. I. cap. iv.

† Observat. lib. VI. obs. xxvi.

‡ Obs. ix. *schol.* *PARAEUS* says, that in his time the like happened on the coast of *Fuscany*. Vid. *De Peste*. cap. III.

fever affecting a ship's crew, upon the putrefaction of some cattle, they had killed in the island of *Nevis*, in the *West-Indies**. These men were seized with a pain in the head and loins, great weakness and disorder of the stomach, accompanied with a fever. Some had carbuncles, and it was remarked that 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 pestilential fevers, incident to an army, is recorded by *Diodorus Siculus*||; which broke out among the *Carthaginians* in *Sicily*, at the siege of *Syracuse*, and proved very destructive. That author not only mentions some of the most distinguishing symptoms, but reasons well about the cause. We find that pains in the back, and eruptions§ were common; that some had bloody stools; and others were suddenly seized with a *delirium*, so as to run about, and beat all that came in their way¶; that

* *Traité de la Peste.*

† *Epidem. Lib. III. sect. iii. referred to before, p. 194.*

‡ *Epit. GALEN. de Feb. Differ. Lib. I. cap. iv.*

|| *Bibliothec. 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 cantonements near *Bois-le-duc*. Vid. Part III. ch. iv. § 2.

they

they died on the fifth, or sixth day at farthest; 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 historian takes notice of the multitude of people confined within a narrow compass; the situation of the camp in a low and wet ground; the cold air from the marshes before sun-rising, succeeded by scorching heats in the middle of the day*. He adds, the putrid steams arising first from the marshes, and afterwards from the bodies of those who lay unburied.

We observed that the first full account of malignant epidemic fevers, attended with *petechiæ*, was given by *Fracastorius*. One of these appeared in the year 1505, and another three and twenty years after; both in *Italy*. This 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, that (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 pesti-

* This is said to be the principal cause of the malignant camp-diseases in *Hungary*.

lential epidemic*. In the year 1694, a fever broke out at *Rochefort*, in *France*, which, on account of the malignant symptoms and great mortality, was at first believed to be the plague†. But M. *Chirac*, who was sent by the court to enquire into the nature of it, found the cause to arise from the salt-marshes, 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 blown long from that quarter. About two thirds of those that were taken ill died‡. The fever raged in *June*, *July* and *August*, and then ended upon a great fall of rain, which purified the air, and refreshed the water.

I might adduce many instances of malignant fevers, occasioned by the putrid effluvia of marshes, from other authors; but as those already mentioned are sufficient to prove what has been advanced, I shall observe upon the whole, that the *bilious*, or remitting and intermitting fevers of low and wet countries,

* *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 much more liable to inundations, and the stagnation of water, than it is at present.

† *Traité des Fievres Malignes: V. Oeuvres Posthumes de M. Chirac. Eloge de M. Chirac, 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.

may be considered as *species* of the malignant or pestilential fever; since a high degree of these have been seen with all the virulent symptoms peculiar to this 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 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 dispose more to a flux, than to any other distemper; for, tho' some will be seized with the hospital-fever by the contagion of bloody stools, yet I have observed, that for the most part that infection produced 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 shores; or where the streets are narrow and foul; or the houses dirty; where water is scarce; where jails or hospitals are crowded, and not ventilated and kept clean; when in sickly times the burials are within the towns‡, and the bodies not laid deep; when slaughter-houses are also within the walls; or when dead animals and offals are left to rot in the kennels, or on dunghills;

* Part III. ch. iv. §. 2, 3. † Part III. ch. vi. §. 3.

‡ SCRETA de Feb. Castrens.

when

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; from the use of old and mouldy grain, or what 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 leaven of a true plague, brought into it by any merchandize. I shall add a few instances in confirmation of these observations.

Constantinople is not only liable to frequent returns of the true plague, but to an annual pestilential fever, that may be considered as the endemic distemper of the 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*

* See TIMONI's account of the plague at *Constantinople* in *Phil. Trans.* abridged, Vol. VI. part iii. ch. ii. sect. xxi.

them-

themselves*. It must therefore be ascribed 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 greatly in *Egypt*†; where the inundations are not solely to be blamed, since that country was more healthful before it became a province of the *Ottoman* empire. And in *Sennar*, where *Mahometanism* is likewise established, pestilential fevers make great ravages; but seldomer 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; and it is well known how much warm bathing, by relaxing the fibres, disposes the body to putrid diseases||. In other points, the *Turks* are not reputed cleanly. Add to this, their abstinence from wine and all fermented liquors, (the great antidotes to putrefaction)§; the principle of fatalism,

* Tho' TIMONI observes, that strangers in general run a greater hazard than the citizens, yet he adds: *Armeni omnium nationum minime ad pestem sunt dispositi: observo illos paucissimis uti carnibus: cepis, porris, alliis, vinoque maxime utuntur.*

† Vid. PROSPER ALPIN. de Med. Ægypt.

‡ Lettres Edifiantes et Curieuses, iv. Recueil.

|| Therefore CELSUS forbids bathing in time of the plague, that is, as was shewn before, during the season in which malignant or pestilential fevers prevail. *De Med. Lib. I. c. x.*

§ We have the following remarkable observation in FORESTUS, on occasion of a plague or pestilential fever that raged

fatalism, which keeps them from avoiding infection; and their ignorance of all learned arts, by which they might know how to prevent or cure such diseases.

In the account of the epidemic malignant fever of *Cork*, in *Ireland*, 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 eat by the poorer people, without bread or fermented liquors, during the victualling season.

Forestus informs us of a plague (rather a pestilential fever), that raged at *Venice* in his time, owing to the corruption of a small kind of fish in that part of the *Adriatic* †. And the same author quotes *Montanus*, for a

raged in his time: *Quicumque aquam ob ingentem calorem febrilem bibissent, ut villicus quidam, ad quem curandum alio morbo affectum, accitus esset, mihi narravit, correpti intra duos dies moriebantur. Qui vero cervisiam bibebant, utpote potum magis huic nostræ regioni consuetum, is morbus protrahabatur.* Dr. ROGERS has observed, "that such as riot on animal food, and drink water only, are subject to putrid and slow fevers"

* See Dr. ROGERS's Essay on Epidemic Diseases. In this book we have a full and curious account of the rise of a malignant fever, and small-pox, deduced from a putrefaction of the air, peculiar to the city of *Cork*, from *August* to *January*. This place being noted for the great number of cattle killed every year (for the use of the navy) which is said to amount to above 120,000 head.

† Observat. lib. VI. obs. ix. schol.

description

description of the pestilential endemic fever at *Famagusta*, in *Cyprus*, arising in summer from the corruption of a lake in the neighbourhood. This 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 fatal malady of this kind. Sometimes it may be owing to the filth of a place, croud-
ed 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 meats long salted becoming putrid.

Tho' the putrefaction of a vegetable substance is not to be reckoned nearly so fatal as that of animals, it is not, however, without danger: 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. *Forestus* imputes the plague at *Delft*, in the year 1557, to the

* DIODOR. Sicul. Bibliothec. Hist. Lib. XII cap. xlv.

† TIT. LIV. anno U. C. 291.

‡ JUL. CÆSAR de Bell. Civ. Lib. II. viz. in his account of the siege of *Marseilles*.

|| Dr. ROGERS's Essay on Epidemic Diseases, p. 41.

eating of mouldy grain, that had been long kept up by the merchants in the time of a dearth*. And I have heard it remarked, that in this island, the dysentery is observed to be most frequent among the common people, in those parts where they live wholly on grain, when the preceding crop has been damaged in a rainy season, or kept in damp granaries.

Jails have often been the cause of malignant fevers, and perhaps no where oftner 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 at Oxford, 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 condemned Rowland Jenkins, for a seditious tongue; at*

* Observat. Lib. VI. obs. ix.

† i. e. the prisoners from the jail.

‡ Natural History Exp. 914.

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 need not have mentioned it here, had it not been to inform such as live at a distance, or those that are to come after us. In the year 1750, on the 11th of May (N. S.) the sessions began at the *Old-Bailey*, and continued for some days; in which time a great number of criminals were tried, and there was present in the court a greater multitude than usually attends. The hall in the *Old-Bailey* is a room of no more than about 30 foot square. Now, whether the air was at first 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†; since, from the latter cause it will be easy to account for its corruption; especially as it was so much vitiated by the foul steams of the *Bail-dock*, and of the two rooms opening into the court, in which

* This account is confirmed by CAMDEN, *vid. Annal. Eliz.*

† It has been the custom, some days before every sessions, to remove all the malefactors from the other jails into *Newgate*, already too much crowded. At such times three hundred may be confined within that narrow space; and it is well known how nasty both this and all the rest are kept.

the prisoners were the whole day crouded together, till they were brought out to be tried*: and, it appeared afterwards, that these places had not been cleaned for some years. The poisonous quality of the air was still aggravated by the heat and closeness of the court, and by the perspirable matter of a great number of all sorts of people, penned up for most part of the day, without breathing the free air, or receiving any refreshment. The bench consisted of six persons†, where-

of

* I have been informed, that at these sessions about a hundred were tried, who were all kept in these close places as long as the court sat, and that each room was but 14 feet by 11, and seven foot 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 which, during the trials, are put some of the malefactors, that have been also under the closest confinement.

† *Viz.* the Lord Mayor, one of the *Lords Chief Justices*, two of the *Judges*, one of the *Aldermen*, and the *Recorder*. Of these died Sir SAMUEL PENNANT, Lord Mayor; Sir THOMAS ARNEY 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; and that the *Middlesex* jury, on the same side of the court, lost so 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 that were on the side of the court to the 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 farthest end of the room from the bench, tho' the judges suffered most. Neither could the kind of the fever, or the mortality

of 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 in the whole; without making allowance for those of a lower rank, whose death may not have been heard of, or including any that did not sicken within a fortnight after the sessions*.

It was said, that the fever in the beginning had an inflammatory appearance†, but that after large evacuations the pulse sunk, and was not to be raised by blisters or cordials, and that the patients soon became delirious. Several had the *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 farther; which was perhaps owing to the season, and to the weather, at that time cold from northerly winds.

attending it, be imputed to any such cause. It is therefore probable, that the fresh air directed the putrid steams to that part of the court above-mentioned. This, indeed, must be granted; that all 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 is the chief means by which the blood is freed from any morbid matter of that kind.

* This number, and the other circumstances relating to this disaster, I had from Mr. Alderman JANSSEN, then one of the Sheriffs, and who, by virtue of his office, was present all the time.

† Vid. p. 247.

By

By Dr. *Huxham's* observations* we find, that the same malignant fever has been frequent at *Plymouth*, at least during the late war, occasioned by the number of prisoners confined to that place, and the hospitals and other places crouded with men taken out of ships, either actually ill of the fever, or of such a scorbutic habit as rendered them very liable to it.

It is remarkable how much the plague, pestilential fevers, hot scurvies and dysenteries have abated in *Europe* within this last century: a blessing we can ascribe to no other second cause, than to the improvement of 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 epidemics (he calls them plagues), 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

* Essay on Fevers, Ch. V. VIII.

† In the first edition, by mistake, I quoted PLATERUS, for having seen ten pestilential epidemics, whereas there were only seven in his time; but each of these continued more than one year. The first, was in the years 1539, 1540, and 1541; the second, in 1550, 1551, 1552, 1553; the third, in 1563, 1564; the fourth, in 1576, 1577, 1578; the fifth, in 1582, 1583; the sixth, in 1593, 1594; and the seventh, in 1609, 1610. Vid. F. PLATER. *Observat. lib. II.*

foreign contagion*. And other authors, their cotemporaries, throughout *Europe*, are full of the like observations. *Foreſtus* remarks, that in his days the plague was moſt frequent at *Cologne* and *Paris*, and imputes the cauſe to the multitude of the inhabitants, and the narrowneſs of the ſtreets†; whereas at preſent both thoſe cities are in general healthy, 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 ſpirituſous liquors coming more into general uſe, have been a great means of ſuppreſſing putrid diſeaſes. Greens and fruit are likewise more univerſally eat|| :
and

* Noſtra memoria quinquies in Dania peſtilentia graſſata eſt, 1619, 1625, 1629, 1637, 1654, ſemper aliunde tranſlata. TH. BARTHOL. de Medicina Danorum Domestica. Diſſert. iv.

† *Colonia & Lutetia Pariſiorum, peſtis frequentiſſima eſt ob hominum frequentiam & 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 he can only mean the laſt; ſince thoſe two cities were the leaſt liable to the true plague, from their inland ſituation.

‡ *Philof. Tranſact. abridged, Vol. VI. Part III. ch. ii. ſect. xxi.*

|| Having aſked Mr. PHILIP MILLER, the celebrated gardiner at *Chelſea*, what he thought might be the proportion between the quantity of greens and fruit conſumed now, and an hundred years ago? he told me, "that in thoſe times he believed

and salted meats make a much less part of diet than formerly. To this add the more general consumption of tea and sugar, which I have shewn elsewhere to be no inconsiderable antiseptics*. How far all these things may be abused, or become productive of other distempers, is not now the question.

For so great a city, *London* is at present perhaps one of the least subject to malignant fevers, the dysentery, or other putrid diseases; with all which it seems formerly to have been infested little less than others; notwithstanding the natural advantages of its situa-

“ lieved the tradesmen and common people about this city
 “ scarce used any, and those of higher rank, very little; for
 “ that he had been assured by the old gardeners and others of his
 “ acquaintance, that so late as sixty years since, a cabbage sold
 “ for 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 pre-
 “ sent extent of ground laid out for kitchen-gardens, he in-
 “ ferred, 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 time bread was dearer in proportion
 to meat than it is now. Hence it seems reasonable to con-
 clude, that formerly a greater quantity of flesh was eat,
 than at present. And it is well known how much more
 salted meats were in common use. Let me add, with re-
 gard to the *farinacea*, that they don’t seem so much disposed
 to resist putrefaction as greens or fruit: as appears by the cure
 of the sea-scurvy, and from some experiments that have been
 made on that subject. See Append. Paper III. Exp. xx. xxi.
 * Append. Paper IV, Exp. xxvi.

tion*. 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 dysentery, and few bilious fevers of a bad kind; or indeed, excepting the small-pox or measles any putrid or malignant distemper that could at all 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 now and then still to be seen, which are scarce heard of among the people of better rank, living in more airy situations. Doubtless many things relating to these matters might be better ordered in this place; yet some of the main points are well regulated; such as regard the privies, common-shores, the supplies of fresh water; and the people are in general very cleanly.

The common dirtiness of the streets does not, perhaps, affect the health of the inhabi-

* *Viz.* In a climate not liable to great heats or close weather, on a gravelly soil, and on the banks of a large river, not only supplying fresh water but fresh air, by the constant motion of the tides. Add, that the city stands in a wide plain, where the surrounding fields are kept pretty open.

† Such as he describes in the *Schedula Monitoria*.

‡ It is not pretended that the foul air of the town alone could produce any of the distempers here alluded to, but that it might concur with the weather to make them more frequent, or the cases worse. It is to be regretted, that this excellent author so rarely mentions the state of the weather, having embraced an opinion, that diseases depended on no manifest change, but some inscrutable quality of the air.

tants of great cities ; and tho' the more offensive kind of it may concur with other things to render the air less healthful, yet it seems to have no direct influence in producing pestilential diseases. Stale urine abounds with a volatile alkaline salt, resisting putrefaction* ; and the common *feces* are rendered less, if at all infectious, by means of a strong acid combined with the parts that are really septic†. The case is different in putrid diseases, and especially in the dysentery, where the *feces*, as we have already shown, are highly corrupted and contagious‡.

I shall conclude this part of my subject with observing, that at the same time that great cities furnish many materials for vitiating the air, they are also provided with two considerable antidotes: the first arises from the circulation of the air, by means of the constant motion of people and carriages, and of the draughts made by fires ; the other depends on the great quantity of an acid, produced by fuel, the strongest resister of putrefaction.

II. Thus far the external causes of the hospital and other malignant fevers seem to

* 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. des Sciences*. A. 1711. HOFFMAN, *Med. Rat. Syst.* Tom. I. lib. i. sect. ii. cap. vii.

‡ Part I. ch. iii. p. 22, 23. Part II. ch. ii. §. 3. Part III. ch. v. §. 1.

be sufficiently ascertained. But in what manner these act and produce the various symptoms within the body, is not so easily to be determined; and the more what follows is to be considered only as conjectural, like what was formerly proposed about the *causa proxima* of the bilious fevers and dysentery.

I conceive that the *miasma* or septic ferment (consisting of the *effluvia* from putrid substances) received into the blood, has a power of corrupting the whole mass*. The resolution of the blood, and sometimes even its smell, in the advanced state of a malignant fever, the offensiveness of the sweats and other excretions, the livid spots, blotches and mortifications incident to this distemper, are proofs of what is here advanced. By its acrimony the nerves are affected with various spasms; the pulse is always quickened, at first raised, but soon deprest upon the heart's not being supplied with spirits, or from a resolution of its fibres occasioned by the putrefaction. I have produced instances elsewhere of the heart's being so far relaxed in a real pestilence, as to become uncommonly large by the ordinary force of the blood†.

Now, were putrefaction the only change made in the body by contagion, it would be easy to cure such fevers, at any period, by the

* FERNEL. *de Febrib. cap. v.* See also the Append. Paper vii. exp. xlvii.

† Append. Paper VII. Exp. xlv.

use of acids, or other antiseptics. But, whereas we have observed, that the disease once formed is not to be removed by any such means, till the stated time of its decline, it seems, therefore, probable, that whilst the septic progress goes on, the fever is chiefly supported by an inflammation of the brain*; that to this circumstance most of the symptoms are owing; and that a cure cannot be expected till the obstructing matter is resolved or suppurated.

This last part of the theory is rendered more probable, by observing the affinity between the symptoms of this fever and those of the *low* and *nervous* kind, which do not depend upon any putrid cause. The sinking of the pulse, pale urine, uncritical sweats, confusion of the head, decay of strength, dejection of spirits, and *tremor* of the nerves, are common to both: and therefore, considering the appearance of the brain in those who died of the hospital-fever, it seems reasonable to conclude, that these symptoms immediately depend upon the inflammation or suppuration of that part.

Another argument may be drawn from the cure. Thus, before the inflammation is fixed, the septic particles may be expelled by sweating; after that period, the most effectual method is to support the strength, but so as not to increase the inflammation. Near

* See the Dissections.

the end of the last stage of the disease, the humours being resolved by putrefaction, the obstruction is thereby removed; at which time the stronger antiseptic and cordial medicines have place, in order to correct and expell what is so much vitiated. In this low state the volatiles are often necessary for raising the pulse*; wine is a constant cordial; and not only wine, but camphire, *serpentaria* and the Bark, are endowed with strong antiseptic qualities†.

These are all the remarks I have made on the nature and cause of *malignant* fevers. In the description I have endeavoured to distinguish them from all others, as far as could be done in distempers with symptoms 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

* The volatile alkaline salts have been recommended by ETMULLER, and other practitioners, in the cure of malignant and petechial fevers; tho' they have been condemned by some authors of the best authority, on account of a putrefying quality supposed to be inherent in them: but it will be found by the experiments in the Appendix, that this opinion is groundless, since all the alkaline salts appear to be of an antiseptic nature. Yet it is not for that intention they are given in the low state of these fevers; but only as cordials, diaphoretics and diuretics: by which qualities, it is presumed, they may be more efficacious in raising the pulse and expelling what is putrid, than hurtful by relaxing the fibres and resolving the blood. However, it is from experience, and not theory, that I take upon me to recommend the volatiles here.

† Vid. Append. Paper II. Exp. xi. xii. xiii.

eruptions

eruptions in the malignant kind *. The nervous fevers seem to belong to the inflammatory class of diseases, tho' incident to such chiefly as are of a weak or lax habit. But whatever gives the first rise to them, if they end in pecthial spots, putrid sweats, or grow contagious, we may from thence safely conclude, that by the long continuance of the disease, the humours are resolved and become putrid: or, in other words, that the nervous fever has changed into one of a malignant form.

C H A P. VII.

Observations on the ITCH.

IN the division of the diseases most incident to an army, this was the last mentioned. It is also of a contagious nature, but the infection is only communicated by the contact of a foul person, his cloaths, bedding, &c. and not by *effluvia*, as in the dysentery and malignant fever. It is confined to the skin, and seems best accounted for by *Leeuwenhoek*, from certain small insects he discovered in the pustules by the microscope †. So that the frequency of the itch in

* I suspect the miliary pustules must have escaped my notice, since so many authors mention their appearing together with the other.

† Since the first edition was published, I have seen a paper in the Phil. Transact. for the year 1703, called, *An abstract of*

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 the first setting out) to others in the same ship, tent, or barrack*. But of all places, the hospitals are the most liable to the contagion, as receiving all sorts of patients. Hence I have observed, that after the *crisis* of fevers, the itch generally appeared, tho' the person was free from it when admitted.

One unacquainted with this disorder may, therefore, be apt to mistake it for a military eruption: especially as these two bear a nearer resemblance to each other, than could be expected in two things of so different a nature. But, those who know how seldom the military eruptions, and how frequently the others are seen in the army, will be less liable to fall into this error. The two may be also distinguished by the following marks; the military pustules appear before the fever is over, are attended with little itching, and go off of themselves; whereas the itch is not perceived till after the *crisis*, in

of a letter from Dr. BONOMO to Signior REDI, containing some observations concerning the worms of human bodies, by Dr. RICHARD MEAD. By which account I find, that Dr. BONOMO was the first that discovered these animalcula, and likewise proposed curing the itch by externals only.

* Part I. ch. ii. p. 15.

the

the convalescent state, when it increases daily, and becomes very troublesome.

Altho' an army cannot be entirely freed from the itch, the cure of each individual is perhaps more certain in this than in any other distemper; and by a method so well known that I scarce need mention it. This I have observed to be least fallible with the private men, who having no change of dress, what they wore was purified at the same time that they themselves were cured; whilst an officer catching the itch, run a hazard of keeping it longer, from the circulation of infection between his body and cloaths.

Sulphur is the specific, being both more safe and more efficacious than mercury. For, unless a mercurial ointment were to touch every part of the skin, there can be no dependance upon it; whereas by a sulphurous one, a cure may be obtained only by partial unctions. It would seem as if these, as well as other insects, were killed by the steams of brimstone, tho' only raised by the heat of the body. And as for the internal use of mercury, which some have accounted specific, we have known several instances, in the hospital, of men undergoing a compleat salivation for the cure of the *lues venerea*, without being cured of the itch.

The ointment was made in this manner :

I

R sulphur.

R. *fulphur. viv. unc. i. rad. bellebor. alb. dr. ij. (vel. sal. ammoniac. crud. dr. i.) axung. porcin. unc. ij. sem. misc. f. unguent.*

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, only a fourth part of the body was anointed at one time. Some are said to cure the disease by rubbing the legs only; but that method was not tried.

Tho' the itch may be thus removed by one pot of ointment, it will be proper to renew the application, and to touch the parts most affected, for a few nights longer, till the second quantity is also exhausted. And in the worst cases, 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: there being reason to believe, that the *animalcula* may sometimes lie too deep, to be thoroughly destroyed by external applications only.

Now as these fumes may heat the blood, at a time the perspiration is so much impeded, it is proper that the patient should live all the while on a cool diet, and guard against cold. If of a full habit, or in any degree feverish, he should bleed and take physic: otherwise, neither of the two evacuations are necessary.

The

The nature of the itch has been often mistaken, whilst some have referred it to the leprous, and other to the scorbutic class of diseases; whereas it seems to be a distemper *sui generis*; at least very different from either of those two. Again, the *psora* of the Greek, and *scabies* of the Latin writers* have been generally supposed to be this very eruption. But, as this does not appear by the description they give of them†, I should conclude, that tho' other diseases of the skin seem to have been formerly no less frequent than at present, yet the itch was either altogether unknown, or at least uncommon in the days of the antient physicians; since they take such particular notice of other cutaneous foulnesses, and wholly omit this.

Again, it may be observed, that in the most marshy parts of the *Low-Countries*, where the true scurvy is so general and bad, the itch is scarce known. And, that tho' both the scurvy and itch may coincide on board our ships, yet they are to be considered as two distinct ailments; the first arising from the foul air and bad provisions; and the other, from the uncleanness of the men, and contagion; each requiring a different cure.

* The one has been always translated by the other. *Vid. GORRAEI Defn.*

† PAULUS *Ægin.* Lib. IV. cap. ii. CELSUS, Lib. V. cap. xxviii.

Both the *scabies* and the various kinds of the *impetigo** of the antients seem now-a-days to be all confounded under the general, but improper appellation of *scorbutic spots*, or *scurfs*†. These are chiefly distinguished by the hardness of the skin, in one or more parts of the body, attended with a dry scurf, sometimes oozing pustules, or dry scabs, and always with some degree of itching. But, they are so far from being curable by externals only, that it is sometimes dangerous to attempt to remove them in that manner. Here, it is necessary to change the humours by a spare diet, exercise, alterative mercurials or frequent purges of the saline kind. But these being no diseases of the army, it would be improper to insist longer upon them here.

* It is plain, that by the *impetigo*, CELIUS 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 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.

A P P E N -

Both

X

APPENDIX,
CONTAINING
EXPERIMENTS

UPON
SEPTIC and ANTISEPTIC Substances.

WITH
REMARKS relating to their Use in the Theory
of MEDICINE.

Read at several MEETINGS of the ROYAL
SOCIETY.

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EXPERIMENTS

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APPENDIX

APPENDIX.

PAPER I.

Experiments shewing, that PUTRID substances are not to be called ALCALINE; 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 strong antiseptic qualities of Myrrh, Camphire, Snake-root, Chamemile-flowers, and the Jesuit's Bark.

Read June 28, 1750.

here printed with a few alterations.

ALTHO' an enquiry 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

* Ld. Bacon calls, "the inducing or accelerating putrefaction a subject of very universal inquiry;" and says, "that it is of excellent use to enquire into the means of preventing or staying putrefaction; which makes a great part

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, from 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 somewhat different from the common opinion; as well as some facts, which, as far as I know, have not been mentioned before.

FINDING it a received notion, that bodies by putrefaction became highly alkaline, I made the following experiments, to enquire how far this may be true.

EXPERIMENT I.

THE *serum* of human blood putrified, made, with a solution of 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 recent urine (of a person in health) which is never accounted alkaline. The same *serum* did not tinge the syrup of violets green; and made no effe-

“ of physic and surgery.” See Nat. Hist. Cent. IV. Add, what is said upon this subject by the celebrated professors BOERHAAVE and HOFFMAN; the former, in his *Aphorisms de Alkali Spontaneo*; and the latter, in his *Dissertation de Putred. Doctrin. &c.*

vescence

vescence when the spirit of vitriol was poured upon it. I made the experiment twice upon portions of different *serum*, both highly putrid; and once on water, in which corrupted flesh had been sometime infused; and 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 not destroyed by the putrid humours. And as to effervescence, having dropped the spirit of vitriol into those liquors unmixed, and also diluted with water, the mixture was quiet, and only a few air-bubbles appeared on shaking the glasses. Upon the whole, tho' there were some marks of a latent *alkali* in the putrid *serum*, they were so very faint, that a quantity of water equal to that of the putrid liquors, mixed with only one drop of spirit of hartshorn, being put to the same trial, shewed more of an alkaline nature, than any of the other.

EXPERIMENT II.

It has been a maxim, that all animal substances, after putrefaction, being distilled, send forth a great quantity of volatile salt in the first water; but Mr. Boyle found, that this held good only in urine; and that in the distillation of the *serum* of human blood putrefied, the liquor which came over first 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 generally 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 urine, the bile and the *crassamentum* of the blood, soon putrefy; the *serum*, the *saliva*, and the white of an egg, slowly. Yet those that soonest corrupt, do not always arrive at the highest degree of putrefaction. Thus the bile is soon corruptible, but the rankness of it is not to be compared to that of flesh; and the white of an egg is not only much less disposed to putrefy than the yolk, but, when corrupted, 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. Whereas, most other animal humours putrefied, tho' of a more intolerable *fætor*, yet contain less volatile salt, less extricable, and not then effervescing with acids. But, what makes the difference between stale urine and other putrid substances still more specific, is its inoffensiveness with regard to health; whilst the steams of most other corrupted bodies are often the cause of putrid and malignant diseases.

* Vid. Nat. Hist. of Human Blood, Vol. IV. p. 178. fol.
Now,

Now, upon finding in urine a much greater quantity of volatile salt, and that more easily separable than in any other humour, and that stale urine is the least noxious of putrid animal substances, so far then from dreading the volatile *alkali* as the deleterious part of corrupted bodies, from this instance we may rather infer it to be a sort of corrector of putrefaction.

EXPERIMENT III.

DAILY experience shews how harmless the volatiles are, both when 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 taken, but also in experiments out of the body.

Now, as to the effects arising from the internal use of them, little can be said, unless the kind of disease was precisely stated. For, supposing they were by their nature disposed to promote putrefaction; yet, if that is already begun, from a *languor* of circulation and obstruction, then may the volatiles, by their stimulating and aperient qualities, be the means of stopping its progress. And on the other hand, tho' they were really antiseptic, yet, if the humours are disposed to corrupt, from excess of heat or motion, these

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 the volatiles, to enquire, whether out of the body, they accelerate or retard putrefaction.

1. In order to decide this question, I have made repeated experiments of joining both the spirit and the salt of hartshorn to various animal substances; and have constantly found, that so far from promoting putrefaction, they have evidently hindered 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, dividing it, put one portion into distilled vinegar, the other into 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 in one 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

* Mr. BOYLE had already observed, that by adding to blood, whilst warm from the vein, fine urinous spirits, they would make it look more florid, keep it more fluid, and long preserve it from putrefaction. Phil. Transact. abrid. Vol. III. ch. v. §. viii.

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; whereby, in less than two days, the mixture without the spirit became putrid, but the other was not only then, but after two days longer, untainted.

3. I afterwards infused two drachms of the lean of beef with two ounces of water, and half a drachm of salt of hartshorn. Another phial contained as much flesh and water, with a double quantity of sea-salt. In a third was the flesh and water only, to serve by way of index. These phials were placed in a lamp-furnace, in a heat varying between 94 and 100 degrees of *Fahrenheit's* scale. About 18 hours after infusion, the contents of the phial which served as an index, were rank; and in a few hours more, that with the sea-salt was also putrid; but the flesh with the volatile *alkali* was sound, and continued so after standing 24 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 pieces of fresh beef, of the same weight as above; and laying two of them in gally-pots, I covered one with saw-dust, and the other with bran; but the third piece being strewed with salt of hartshorn powdered, I
put

put into a four-ounce phial that had a glass stopper. They were all three placed on the outside of a window, exposed to the sun; and the weather being warm, on the third day, the flesh in the gally-pots began to smell; on the fourth, were putrid. Next day the phial was examined, when the flesh was washed from the salt, and found quite sweet. It was then dried and salted again with hartshorn; and having stood in the house some weeks longer, in sultry weather, it was looked at a second time, and observed to be as sound as before: neither was the substance at all dissolved, but was of such a consistence as might be expected from common brine*. And, lest it might be suspected that the flesh in the gally-pots, 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 hartshorn, and found the confinement rather hasten the putrefaction.

Now, by these and many other experiments of the kind, finding that volatile alkaline salts not only do not dispose animal substances to putrefaction out of the body, but even prevent it, and that more powerfully than common sea-salt, we may presume, that the same taken by way of medicine, will, *cæteris paribus*, prove antiseptic; at least, we

* The same piece has been since kept a twelvemonth, and is still untainted, and as firm as at first.

cannot justly suppose them corrupters of the humours, more than fermented spirits or sea-salt; which taken in immoderate quantities may raise a fever, and thereby accidentally be the occasion of corruption.

EXPERIMENT IV.

I HAVE likewise made several experiments with the fixed alkaline salts, which have no less antiseptic powers than the volatile. The trials were made both with the lye of tartar and salt of wormwood. But here, we must not confound a disagreeable smell of such mixtures, with one that is really putrid; nor the power those lixivials sometimes may have of dissolving 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, the mixtures of the two, to saturation, would resist putrefaction little less than the acid alone. But in the trials I have made

* In the trials upon flesh I observed, that tho' the fixed alkaline salts seemed at first to loosen the texture of fibrous animal substances, yet after some days infusion those pieces not only were not dissolved, but were firmer than others that had lain in water only.

upon flesh with a *spiritus Mindereri*, composed of vinegar, saturated with salt of hartshorn, and also with the juice of lemons saturated with the salt of wormwood, I found the antiseptic virtue considerably less than when either the acids or *alkali's* were used singly.

EXPERIMENT VI.

As for the comparative virtues of these salts upon flesh, I found 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; but when the trial was made with ox's gall, that two drachms of this mixture were more antiseptic than a scruple of that salt. Again, that nitre compared with the dry neutral salts, weight for weight, was more antiseptic than any I had tried, in preserving flesh. Crude *sal ammoniacum* 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 qualities.

EXPERIMENT VII.

Thus far have I examined the common neutral salts; which, however powerful in resisting putrefaction, are inferior to some
4 refinous

resinous substances, and even to some plants that I have tried. Thus 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 that salt: and I imagine, could the camphire be kept from flying off, or concreting to the sides of the phial, that 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. Chamemile-flowers have nearly the same extraordinary quality. The Jesuit's Bark has it also; and if I have not found it so strong as the two substances last mentioned, I impute that in part to my not being able to extract its embalming parts in plain water.

Now, vegetables possessing this balsamic virtue, are the more valuable, in that, being usually free of acrimony, they may be taken in much greater quantities, than either spirits, acids, resins, or even the neutral salts. And as in the great variety of substances answering this purpose, there may be also some offensive or useful qualities annexed, it may not be amiss to review some part of the *materia medica* for this intention.

I shall add, that besides this extraordinary power in preserving bodies, I have discovered in some of those substances a sweetening or correcting

correcting quality, after putrefaction had actually begun. But these experiments I shall lay before the Society some other time; with a Table of the comparative force of salts, and some farther remarks on the same subject.

P A P E R II.

A continuation of the experiments and remarks upon antiseptic substances; viz. A Table of the comparative powers of salts in resisting putrefaction. Of the great 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 chamemile-flowers, and the Bark. A conjecture about the cause of intermitting fevers; and the action of the Bark, in curing both them and mortifications.

Read Nov. 21,
1750.

HAVING in my last paper just mentioned the comparative force of a few salts, and other substances resisting putrefaction, I shall now lay before the Society a particular account of those experiments, with some others since made on that subject.

E X P E -

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 30 grains of sea-salt*; in another 60; but the third contained nothing but flesh and water. These bottles were little more than half full; and, being corked, were placed in a lamp-furnace, regulated by a thermometer, and kept about the degree of human heat.

About ten or twelve hours after, the contents of the phial without salt had a faint smell; and in three or four hours more were putrid†. In an hour or two longer, the flesh with the least salt was tainted; but that which had most, remained sweet above 30 hours after infusion. This experiment was often repeated, with the same result, making allowance 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

* All these experiments were made with the white or boiled salt in common use here.

† These pieces were entire; but when they are beat to the consistence of a pap, with the same quantity of water, the putrefaction begins in less than half the time mentioned above.

Y

than

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 with 30 or 60 grains of sea-salt. But if, on the other hand, water, with any addition, promoted corruption more than when pure, the substance added was to be reckoned a septic, or hastener 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, whereas the least quantity of salt preserved flesh little longer than plain water, I shall always compare the several antiseptic bodies with the greatest quantity: so that whenever any substance is said to oppose putrefaction more than the standard, I mean more than 60 grains of sea-salt.

EXPERIMENT IX.

I THEN examined other salts, and compared them, in the same quantity, with the standard; which being of all the weakest, I shall suppose it equal to unity, and express the proportional strength of the rest in higher numbers, as in the following table.

A

*A Table of the comparative Powers of Salts
in resisting Putrefaction.*

Sea-salt	-	-	-	-	1
<i>Sal gemmæ</i>	-	-	-	-	1 +
Tartar vitriolated	-	-	-	-	2
<i>Spiritus Mindereri</i>	-	-	-	-	2
<i>Tartarus solubilis</i>	-	-	-	-	2
<i>Sal diureticus</i>	-	-	-	-	2 +
Crude <i>Sal ammoniacum</i>	-	-	-	-	3
Saline mixture	-	-	-	-	3
Nitre	-	-	-	-	4 +
Salt of hartshorn	-	-	-	-	4 +
Salt of wormwood	-	-	-	-	4 +
<i>Borax</i>	-	-	-	-	12 +
Salt of amber	-	-	-	-	20 +
Alum	-	-	-	-	30 +

In this table I have marked the proportions by integral numbers; it being hard, and perhaps unnecessary, to bring this matter to more exactness; only to some I have added the sign +, to shew, that those salts are stronger than the number in the table by some fraction; unless in the three last, where the same sign imports, that the salt may be stronger by some units*. The tar-

* Five grains of *Borax* was the smallest quantity compared with 60 gr. of sea-salt; but holding out so much longer, I suspect that 3 gr. 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

tar vitriolated is rated at 2, tho' more than 30 grains were taken to equal the standard: but perceiving 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 shewn by the table. The salt of amber is likewise volatile; and as three grains thereof were found more preservative than 60 of sea-salt, it must therefore be more than 20 times stronger. This is indeed an acid salt, but as the acid part is inconsiderable, the high antiseptic power must be 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 acid added, rendered these salts less antiseptic; viz. the *spiritus Mindereri* by a half, and the saline mixture by a fourth part: which was a circumstance very unexpected.

grain of alum was weaker than 60 grains of sea salt; but 2 grains were stronger. The power therefore of alum lies between 30 and 60; but, by the experiment, nearer the first number.

* Both the *spiritus Mindereri* and the saline mixture, being in a liquid form, are compared with the dry salts, upon the quantity they contain of the alkaline salts.

EXPE-

EXPERIMENT X.

1. I PROCEEDED to try resins and gums, and began with myrrh. As part of this 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, preserving the flesh longer than the standard, we may account the soluble part of myrrh, perhaps, about 30 times stronger than sea-salt.

2. Aloes, *asa fætida*, and the *terra japonica*, dissolved in the same manner as myrrh, like it subsided, and had the same antiseptic force. But gum-ammoniac and *sagapenum* shewed little of this virtue. Whether it was, that they opposed putrefaction less, or that all 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 tenderer than with any of the stronger antiseptics.

3. Of all the resinous substances, camphire resisted most. Two grains dissolved in one drop of spirit of wine, five grains of sugar, and two ounces of water, exceeded the standard; tho', during the infusion, most of the

camphire flew off, swam at top, or stuck to the phial. Suppose only the half lost, the remainder was at least 60 times stronger than the salt; but if, as I imagine, the water suspended not above a tenth part, then camphire will be 300 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 this mixture less perfect, but still beyond the standard.

EXPERIMENT XI.

1. I MADE strong infusions of chamemile-flowers, and of *Virginian* snake-root; and finding them both greatly beyond the standard, I gradually lessened the quantity of these materials, till I found five grains of either impart a virtue to water superior to the standard. Now, as we cannot suppose that these infusions contained half a grain of the embalming part of those vegetables, it follows, that this substance must be at least 120 times more antiseptic than common salt.

2. I also made a strong decoction of the Bark, and infused a piece of flesh in two ounces of it strained; which flesh never corrupted, tho' it remained two or three days in the furnace, and the standard was putrid. During this time the decoction became gradually

dually limpid, whilst the groffer parts subsided: by which it appears, that a most minute portion of the Bark (perhaps less than of the snake-root or chamemile-flowers) intimately mixed with water, is possessed of a very extraordinary 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. Mint, angelica, ground-ivy, fenna, green-tea†, red roses, common wormwood, mustard, and horse-radish, were likewise 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 very powerful resisters of putrefaction. Farther, I made a trial with a 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, fermented spirits, spices and acids, commonly known to have this property, many resins,

* Tho' the experiment was only made with ten grains of the powder of this root, yet, considering how long that quantity resisted putrefaction, we may reckon the valerian among the strongest antiseptics.

† Bohea tea was not tried.

astringents and refrigerants are of the number; and even those plants called anti-acids, and supposed hasteners of putrefaction: of which class horse-radish is particularly antiseptic. And indeed, after these trials, I expected to find almost all substances endowed with some degree of this quality; till, upon farther experiments, I perceived some made no resistance, 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 plants would part with this virtue without infusion. For this purpose, having three small and thin slices of the lean of beef, I rubbed one with the powder of the Bark, another with that of snake-root, and a third with that of chamemile-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 quite sweet. The substance of all the three was firm; particularly that with the chamemile, which was so hard and dry, that it seemed incorruptible. Why the Bark had
not

not altogether the same effect, was probably owing to its close 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, the only things known to answer this intention, are of too acrid and irritating a nature to be thoroughly useful, when this correction is most wanted. As for 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 therefore very tender, spongy and specifically lighter than water) was thrown into a few ounces of the infusion of chamemile-flowers after expressing the air, to make it sink in the fluid. The infusion was renewed twice or thrice in as many days; when perceiving the *fætor* gone, I put the flesh into a clean bottle, with a fresh infusion; and this I kept all the summer, and have it still by me, quite sweet, and of a firm texture*. In like manner I have been able to sweeten several small pieces of putrid flesh, by repeated affusions of a strong

* This piece after being kept a twelvemonth in the same liquor, was still firm and uncorrupted.

decoction

decoction of the Bark : and I constantly observed, that not only the corrupted smell was removed, but a firmness restored to the fibres.

Now, since the Bark parts with so much of its virtue in water, it is natural to think it may still yield more in the body, when opened by the *saliva* and bile ; and therefore, that it is by this antiseptic virtue it chiefly operates. From this principle we may account for its success in gangrenes, and in the low state of malignant fevers, when the humours are so evidently putrid. And for intermitting fevers, in which the Bark is most specific, were we to judge of their nature from circumstances attending them in climates and seasons, most liable to the distemper, we should assign putrefaction as a principal cause. They are the great endemic of all marshy countries, and rage most after hot summers, with a close and moist state of the air. They begin about the end of summer, and continue through autumn ; being at the worst when the atmosphere is most loaded with the *effluvia* of stagnating water, rendered more putrid by vegetables and animal substances that die and rot in it. At such times all meats are quickly tainted ; and dysenteries, with other putrid diseases, coincide with these fevers. The heats dispose the humours to acrimony ; the putrid *effluvia*
are

are a ferment*; and the fogs and dews, so common to those climates, stop perspiration, and bring on a fever. The more these causes prevail, the easier it is to trace this putrefaction of the humours. The *nausea*, thirst, bitter taste of the mouth, and frequent evacuations of putrid bile are common symptoms, and arguments for what is advanced. We shall add, that in moist countries, in bad seasons, the intermittents not only begin with symptoms of a putrid fever, but, if unduly managed, easily change into a pestilential or malignant form, with livid spots, or blotches, or a mortification of the bowels. But, as a thorough discussion of this question might carry us too far from our present subject, and be unseasonable here, I shall refer it to its proper place, and only remark, that whatever medicines (besides evacuations and the Bark) have been found useful in the cure of intermittents, they are, so far as I know, all highly antiseptic; such are myrrh, camphire, chamemile-flowers, wormwood, tincture of

* 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 shew, that putrid animal substances become ferments, in the strictest sense; that is, act as yeast, when joined to any vegetable substance capable of a vinous fermentation. Vid. Exper. xxviii. & seq.

roses, alum with nutmeg, vitriolic or strong vegetable acids with aromatics.

Thus far I have recited my experiments upon flesh, or the fibrous parts of animals; I shall next proceed to shew, what effects antiseptics have upon the humours. For, tho' from analogy we may 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 new trials; which, with some experiments on the promoters of putrefaction, the reverse of the former, shall be offered to the Society at another 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 oeconomy. Of the different means of inducing putrefaction. Some substances, reputed septic, have a contrary quality. And the real septics are some of those very substances which have been the least suspected to be of that nature: viz. chalk, the testacea and common sea-salt.

Read Nov. 15, 1750. **H**AVING given a particular account of the manner of trying antiseptics on the fibrous parts of

of animals, I shall only mention the result of some experiments made with them upon the humours*.

EXPERIMENT XIV.

DECOCTIONS of wormwood, and of the Bark, also infusions of chamemile-flowers, and of snake-root, preserved yolks of eggs, not only several days longer than water did alone, but also when a good quantity of 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 lye of tartar, spirit of hartshorn, crude *sal ammoniacum* and the saline mixture; and still longer by a decoction of wormwood, infusions of chamemile-flowers, and of snake-root; by solutions of myrrh, camphire, and salt of amber: all 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, tho' four times

* All the following experiments, whether made in the lamp-furnace, or by the fire, were in a degree of heat equal to that of the human blood, *viz.* about 100 degrees of FAHRENHEIT's scale.

stronger

stronger than sea-salt in keeping flesh sweet, is inferior to it in preserving gall; and remarkably weaker than crude *sal ammoniacum*, which again is somewhat less powerful than nitre in preserving flesh. The nitre was soon opened by the gall, and emitted a vast quantity of air, which rose as from a fermenting liquor; and when this happened, the gall began to putrefy. But the saline mixture generated no air, and opposed the putrefaction of the gall more than it did that of flesh.

EXPERIMENT XVI.

THE last trial was with the *serum* of human blood, which was preserved by a decoction of the Bark, and an infusion of snake-root; nor with less efficacy than flesh. 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 well mixed. Nitre acted nearly with its full force, being about four times stronger than sea-salt; and it generated some air, but much 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 preservative of flesh, will be universally antiseptic, tho' perhaps not always with equal force.

EXPE-

EXPERIMENT XVII.

HAVING already shewn how putrid flesh might be sweetened, I shall conclude this part of my subject with a like trial upon the yolk of an egg. A portion of this being diluted with water, stood till it corrupted; when a few drops were put into a phial with two ounces of pure water, and about twice as many drops were mixed with a strong infusion of chamemile-flowers. At first, both phials had some degree of a putrid smell; but being corked, and kept a few days near a fire, the mixture with plain water contracted a strong *fætor*, whilst the other smelled only of the flowers.

Thus far have I related the 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, cooling, volatility, astringency, and the like; which make some more adapted than others to particular indications. In some putrid cases, many correctors are already known; in others, they are wanting. For, we are yet at a loss how to correct the *sanies* of a cancerous ulcer; but, from such a multitude of antiseptics, it is to be hoped, some may be found, at last, adequate to that intention.

It

It may be farther 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 dissolved, or disposed to putrefaction, either from a bad habit, or the absorption of putrid matter, then is the Bark the 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, and sizziness of the blood (a state very different from the other) has such consequences as may well be expected.

By the success of the Bark in so many putrid cases, it should appear, that astringency had no small share in the cure†. And, indeed the very nature of putrefaction consists in a separation or disunion of the 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 highly antiseptic power, with little or no appearance of the other quality. And since several of these medicines are also

† All astringents seem to be strong antiseptics ; and all antiseptics probably have some astringent quality, tho' not always manifest.

diaphoretic, their operation is thereby rendered more successful.

I come now to the second thing proposed, which was, to give an account of some observations made on substances hastening or promoting putrefaction; an enquiry not less useful than the former. For, setting aside the offensive idea commonly annexed to the word, we must acknowledge putrefaction to be one of the instruments of nature, by which many great and curious 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. Many distempers proceed from a deficiency of this action*. The *crisis* of fevers seems to depend upon it†; and even animal heat, accord-

* Some authors of great repute mean the same thing, when they express this by a defect of a due degree of *alcalescence* in the humours: but I have shewed in my first Paper how liable this term was to objections.

† It is observable, that HIPPOCRATES entertained the same idea, since he oftner than once uses the word, signifying *to putrify*, as synonymous to that which signifies *to concoct*. Thus the learned GORRÆUS remarks, Σήπτει, quod est putrefacere, HIPPOCRATI concoquere significat; ut et σήψις concoctionem. Vid. Definit. And agreeably to this HIPPOCRATES (in Lib. de Dieta) makes use also of this phrase, σιωνάρως διαχώνησα putrefactæ fæces, which has been commonly rendered *alvi egestio concocta*. Now, that the concoction of the humours is nothing else but a putrefaction, seems probable from hence, that whenever they are in that state, they are always more fluid, and fitter to pass through the smaller vessels, where they stagnated before. But, *resolution* or tenuity is one inseparable character of putrefaction. And we often

according to the late ingenious theory of my learned friend Dr. *Stevenson* §.

But, in the prosecution of this subject, I have met with very few real septics; and found many substances, commonly accounted such, to be of a quite opposite nature. The most general means of accelerating putrefaction, is by heat, moisture, and stagnating air; which being sufficiently known and ascertained, I passed over, without making any particular experiments on those heads. Lord *Bacon* †, as well as some of the Chemists, has 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 farther illustration of the matter.

find, in the offensiveness of the sweats, or other excretions consequent on a *crisis*, indisputable marks of a high degree 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 such a variety in the duration of fevers of different kinds, and uniformity in 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 was putrid but what was offensively so; whereas, in fact, every fibre becoming more tender, and humour thinner, may be considered as putrid in some degree; whether the change tends to the better health or to the destruction of the person, or whether it becomes grateful or offensive to the senses.

§ See an Essay on the Cause of animal Heat, inserted in the Medical Essays, Vol. V. In this treatise the reader will find several curious observations relating to animal putrefaction.

† Vid. Nat. Hist. Cent. IV. Exper. 330.

EXPE-

EXPERIMENT XVIII.

IN the yolk of an egg, already putrid, a thread being dipped, a small portion was cut off and put into a phial, with half of the yolk of a new-laid egg diluted with 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 advances quicker in a confined than a free air; for, as the most putrid parts are also the most fugitive, they incessantly issue from a corruptible substance, and disperse with the wind: but, in a stagnation of air, they remain about the body, and by way of ferment excite it to corruption ||.

EXPE-

|| *Corpus in putredine existens, alii (corpori) a putredine libero facillimè corruptionem conciliat; quia illud ipsum (corpus) quod in motu intestino jam positum est, alterum quiescens, ad talem motum tamen proclive, in eundem motum intestinum facile abripere potest.* STAHLII *Fundam. Chymicæ. Part. 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. Subterræn. 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

EXPERIMENT XIX.

As for other septics, recited by authors, I found none of them answer the purpose. 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 tho' they preserve 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 hinder the coagulation of blood; and when taken by way of medicine, perhaps

words *fermentation* and *putrefaction* of the blood promiscuously, in his piece called Observations and Experiments on the Human Blood. But these authors are, nevertheless, very 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 they wrote in. 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 my frequent 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.

thin

thin and resolve it; but are not therefore septics. For, so little do these salts putrefy, or even resolve the fibres, when applied dry, that I have kept since the beginning of *June* last, notwithstanding the excessive heats, a small piece of flesh in a phial, preserved only with salt of hartshorn, at present perfectly sound, and firmer than when first salted*.

EXPERIMENT XX.

FROM the specimens we had of the antiscorbutic plants, it is likewise probable that none of that tribe will prove septic. Horfe-radish, one of the most acrid, is a very powerful antiseptic. And tho' carrots, turnips, garlic, onions, celery, cabbage and colewort, were tried (as *alcalescents*) they did not hasten, but kept back the putrefaction.

EXPERIMENT XXI.

THE case was different with such farinaceous vegetables as were examined; *viz.* white bread in infusion, decoctions of flour, barley, and oatmeal; for, these did not at all retard putrefaction; but, after that process was somewhat advanced, they checked it, by turning sour. By a long digestion, the acidity became so considerable, that by conquering

* This piece remained uncorrupted, tho' kept above a year and a half after the experiment was made.

the putrescency of the flesh, and generating much air, did not ill represent the state of weak bowels, which convert bread and the mildest grains to such an acid, as prevents a due *resolution* and digestion of animal food*.

EXPERIMENT XXII.

I EXAMINED *cantbarides*, dried vipers, and *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 for the castor, so far from promoting this process, an infusion of 12 grains thereof opposed putrefaction more than the standard salt.

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 crabs-eyes prepared, were mixed with six drachms of ox's gall, and as much water; into another phial was

* 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, being hitherto overlooked, shall be therefore set forth in my next Paper.

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 powder was, than in the other phial. I also infused in the same furnace 30 grains of prepared chalk, with the usual quantity of flesh and water†; and observed, that the corruption not only began sooner, but rose higher by this mixture; nay, what had never happened before, that in a few days the flesh was resolved into a perfect *mucus*. The experiment was repeated with the same effect; which being so extraordinary, I suspected that some corrosive substance had been mixed with the powder: but, for a trial, a lump of chalk being pounded, 30 grains thereof proved fully 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 alike: but after three days warm digestion, the salt had neither tainted nor softened the flesh, whilst the chalk had rotted and consumed that which was joined to it. Nor were the effects less of the testaceous powders of the Dispensatory. But egg-shells, in water, seemed to resist putrefaction, and to preserve the meat longer than water did without them*.

† *Viz.* of flesh two drachms, and of water two ounces.

* The trial was made with a coarse powder of this substance, but not repeated.

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, without the *testacea*. 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 tho' it softened it, yet made no mucilage, and remained sweet.

EXPERIMENT XXV.

NOTHING could be more unexpected than to find sea-salt a hastener of putrefaction: but the fact is thus. One drachm of salt preserves two drachms of fresh beef, in two ounces of water, above 30 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 twenty hours longer than pure water; but half a drachm of salt does not preserve it above two hours longer. This experiment has been already mentioned. Now I have since found, that 25 grains have little or no antiseptic virtue; and that 10 or 15, or even 20 grains manifestly both hasten and heighten the

the corruption*. It is moreover to be remarked, that in warm infusions with these smaller quantities, the salt, instead of hardening the flesh (as it does in a dry form, in brine, or even in solutions, such as our standard) it here softens and relaxes the texture of the meat, more than plain water; tho' much less than water with chalk or the testaceous powders.

Many inferences might be made from this experiment; but I shall only mention one. 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, since it is never taken in aliment beyond the proportion of the corrupting quantities in our experiment, it would appear that salt is subservient to digestion, chiefly by a septic virtue; that is, by softening and resolving meats: an action very different from what is commonly believed§.

* I found the most putrefying quantity of salt, with this proportion of flesh and water, to be about 10 grains.

§ BECCHER is the only author, I know, that hints at the resolving quality of sea-salt, and also at its corrosive and putrefying nature, when taken too freely in aliment. *Vid. Physic. Subterr. Lib. I. sect. v. cap. i. n. 34.*

It is to be observed, that all the above-experiments were made with the white or boiled 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. An account of a power discovered in putrid animal substances for exciting a vinous fermentation in vegetables; and of what use the saliva is in that process: with an application of these experiments to the theory of digestion.

Read April 25,

1751.

IT being so established an opinion, that salt resists putrefaction with a power proportioned to its quantity, I did not therefore rely on my first trials, but repeated that experiment often which contradicted this maxim; and I still found, that two drachms of fresh beef, with from five to twenty grains of sea-salt, and two ounces of water, putrefied sooner than the same quantity of flesh infused in water only.

EXPERIMENT XXVI.

1. I NEXT enquired, if small portions of other neutral or alkaline salts were in like manner septic; but upon examining crude *sal ammoniacum*, nitre, vitriolated tartar, *sal diureticus*, as also salt of hartshorn, and salt
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of wormwood, I could not perceive they were: tho' all of them in weak solutions were found to soften or resolve the flesh; salt of hartshorn most, but nitre least of any.

2. Neither does sugar at all promote putrefaction. A plain syrup is said to preserve meat better than any brine; and from the trials I have made, this seems to be true: as also, that weak solutions of sugar are proportionally antiseptic. But, what is most remarkable here, tho' weak solutions thereof soon yield to the putrefaction of flesh, yet as soon as an acidity is produced from the sugar's fermenting, that putrid tendency is either very much retarded, or entirely overcome. Wherefore, in sugar the effects of both the *farinacea* and salts seem to be combined; 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 in large quantities is daily joined to other acescent food, we may perhaps ascribe some share of the general decline of putrid diseases. For, how seldom do we now hear of leprosy†, hot scurvies, dysenteries, plagues, pestilential fevers, and the like distempers, formerly so frequent; and to which those were peculiarly subject who used animal diet in excess,

† Viz. the *Lepra Arabum*.

especially

especially salted meats||? No doubt many other causes concur; but to enumerate them would be foreign to our present purpose, as well as to mention the inconveniencies that may arise, on the other hand, from the immoderate use of such things as too much oppose putrefaction.

3. I have also repeated the experiments with the *testacea*, and in particular on human blood, and found that crabs-eyes promoted the putrefaction of the *crassamentum*, and likewise that of the *serum*, but not so speedily.

EXPERIMENT XXVII.

I. HAVING a mind to see the action of the *testacea* combined with an antiseptic, I infused half a 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 tho', upon the whole, the powder did indeed resist putrefaction, it was with much less efficacy than if the small portion of the root, that enters the composition, had been used alone*.

2. To

|| Add what is said in the OBSERVAT. Part III. ch. vi. §. 6. p. 294.

* The high opinion physicians of the last century entertained of the *testacea*, and of their extensive use, was founded on an *hypothesis*, that most diseases proceeded from an acid,
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2. To this examination of chalk and the *testacea* were added some experiments upon lime-water, made both of common lime and oyster-shells; and I found, that tho' flesh infused in either immediately sent forth a disagreeable smell, as in a common lye, yet it did not become putrid till after the standard. So that, in this trial, lime-water made some small resistance to putrefaction, tho' the materials of which it was made, namely chalk and shells, are both septics: nevertheless, I have observed, that when the putrefaction began, it became always much more offensive in this than in common water. And it otherwise appears probable, that the virtues of this medicine do not so much consist in correcting putre-

not even excepting fevers. Now, tho' this theory is at present much limited, yet the practice is still common, at least in acute distempers; some using these powders from custom chiefly, 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: tho' partly from these experiments, and partly from practice, I have been led into another opinion. However, I would not from hence infer, that the *testacea* were only to be given when an acid was 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. The primary effects of mercurials consist in a septic *resolution* both of the fibres and humours. Possibly, therefore, the *crisis* of some fevers may be hastened, or perfected by the *testacea*, which we have shewn to be substances endowed with a considerable putrefying quality.

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faction, as in checking immoderate acidities and concretions, the cause of many chro-
nical diseases.

Thus far have I related my experiments upon substances resisting, and promoting putrefaction; by which it seems probable, that, of the former, there is an infinite number; of the latter, few; tho' perhaps many more than we have yet discovered. In this last part I have confined my enquiries 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.

EXPERIMENT XXVIII.

I MADE several mixtures, each consisting of two drachms of raw beef, as much bread, and an ounce of water: these being beat to the consistence of a pap, were put into close phials, of three or four ounces measure, and placed in the usual heat of 100 deg. But in this, and in many of the subsequent experiments,

riments, the furnace was allowed to cool for some hours every 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, that if the corks had not frequently 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 the 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 farther proof of the preceding fermentation. This change was the more extraordinary, that when the motion began, these mixtures were tending to corruption, and in effect in a few hours after became offensive: but next day, the putrid smell abated, and went quite off before the fermentation was over.

2. I repeated these experiments often, and with the same success. And to be ascertained of the part the animal substance had in producing such effects, I made mix-

* 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.

tures of bread and water only, which stood several days in the furnace, without any sign of fermentation.

3. I added, to two drachms of fresh meat, double the quantity of the bread, and water in proportion; and putting this mixture in the furnace, I observed the fermentation proceed as before, and with no other effect 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 if oatmeal and water would ferment alone; but tho' it did, the action was not near so strong as when an animal substance was added.

7. Experiments were also made with bread and roasted meat, with similar effects; for, tho' the putrefaction was but just discernible, and the generation of air was much less than in the first experiment, yet the fermentation was compleat, and the mixtures became acid.

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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 most 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 therein a very 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 this liquor, in a phial, and placed it in the furnace, I perceived that this mixture 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 at the first, without becoming acid.

From all these experiments it seems probable, that most animal substances tending

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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 it before.

11. After these 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 was added in the beginning ten drops of the spirit of vitriol; and after both had stood some days in the furnace, I found the first apparently most acid. To account for this, it will be proper to observe, that the addition of the spirit preventing fermentation, the last mixture had no more acidity than what was given to it at first by the vitriol.

12. I have also remarked, 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

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, putrified slower than another, which had no *saliva* joined to it.

EXPERIMENT XXX.

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 digestion. This mixture, being beat 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 this action became manifest. At that time I

* The *saliva* is reckoned by the celebrated STAHL among those substances 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 it 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 which may be necessary for conducting that process in a hot climate.

found the bread and flesh risen in the water, a sediment forming, and bubbles of air continually mounting: in a word, that the fermentation was compleat, 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, it was much more moderate, and generated air with little tumult. When the fermentation intirely ceased, the mixture had a pure acid taste, tho' weaker than what was produced in the former experiments: and I took notice, that it was without any putrid smell from the beginning.

2. I likewise varied this experiment, as I had done the first, in using roasted meat instead of raw, and sometimes oatmeal in place 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 beat together, were allowed to ferment in a heat of 65 degrees, and having examined the phial with a thermometer, I found it about three degrees warmer than the external air*.

From

* It is probable, that in a fermentation of this kind, the heat increases greatly in proportion to the quantity of the mixture. In so small a quantity I doubt that neither vegetable nor animal substances, fermenting separately, would raise any perceptible degree of heat: tho' vegetables alone are capable of acquiring an intense heat, (so indeed as to break out into

From these last experiments it appears, that if the *saliva* is well prepared, is 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 the *saliva* is deficient, unsound, or not well mixed with what is swallowed, that the aliment may first putrify, then grow acid, and in that action ferment strongly, and generate much air in the stomach and bowels.

P A P E R 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 alkaliescent 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 whence a sourness of the stomach proceeds.

Read June 20, 1751. **I**N my last Paper I gave an account of some observations

made upon the fermentation of the *farina* 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 acefcent parts, exactly as in the experiment above.

cea, by means of animal substances; but not having then finished that subject, I shall now lay before the Society a few more experiments relating to it.

EXPERIMENT XXXI.

AFTER seeing the effects of the fresh *saliva*, both in keeping up and moderating fermentation, I wanted to know 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 usual proportion thereof to the common mixtures of bread, flesh and water; which, 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 was at last sweetened by the acid, produced by 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 all animal substances have a power (in proportion to their degree of corruption) of exciting a fermentation in the common *farinacea*.

* *Viz* blood warm, or about 100 degrees of FAHRENHEIT's thermomete; and the same degree of heat is to be understood as used in the rest of the experiments, unless when it is otherwise expressed.

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 put 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, float in the water, and 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 former retained the corrupted smell 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 yielded such a vinous smell, as was taken notice of before, when the fresh *saliva* was added to the common mixture with the beef.

† Exper. xxx.

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Having therefore observed in this instance, such an exact agreement between the effects of fish and of flesh, in causing fermentation, and presuming, that all fish was possessed more or less of the same quality, I did not repeat the experiment with any other other fort. For, tho' 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 to produce more or less of an acid; yet, as those disquisitions would have taken up too much time, I omitted them for the present, and pursued the general point of enquiring how extensive this principle, of exciting fermentation, was among other animal substances.

EXPERIMENT XXXIII.

I MADE, therefore, a trial with the yolks of new-laid eggs. One of which 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 the *saliva*. But tho' 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 Réaumur's observation about

about the slow putrefaction of unimpregnated eggs, I concluded, that either these two happened to be so, and therefore resisted putrefaction so much the longer; or, what was most likely, that by a small degree of acidity in the bread, they had been preserved wholly from corrupting, and of course from fermenting too. So that this experiment ought to be no exception to the general observation, that all animal substances, upon putrefying, become ferments to the *farinacea*,

EXPERIMENT XXXIV.

HAVING remarked, that the liquor resulting from all the fermentations, had not only a sour but an austere taste, that I might be sure 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, which yielded the same kind of an astringent acid as the other: and, as I remember, oatmeal afforded an acid little different from the rest.

Hitherto having seen how fermentable some of the *farinacea* are, by means of corrupted animal substances; and how probable it is, that the rest of this class of vegetables agree in the same quality with the specimens; I shall next relate some experiments made upon vegetables of a different kind.

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EXPERIMENT XXXV.

In one phial I put two drachms of fresh beef, with a handful of new-cut spinage, and two ounces of water. In a second, the same quantity of flesh, half an ounce of boiled spinage, and between two and 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 scurvygrass, and two ounces of water. The sixth and last phial served for a standard, with the usual mixture of beef, bread and water only.

In less than five hours after setting them in the furnace, I found in a fermenting state, not only the standard, but the contents of the two phials with the asparagus. 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 corrupted smell, and afterwards lost it; and next day, or about 30 hours after infusion, the acid prevailed: which, tho' considerably less than that of the standard, was yet sufficient for curdling milk. But the
great

great 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 that with the asparagus was so weak, that in two or three days after, 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 the curdling of milk: but after this period, as was remarked of the asparagus, both these spinage-mixtures became putrid.

The scurvy-grass 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 in this it differed, that after this change, it continued to preserve the meat longer from corruption. By which it appears, that tho' 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 scurvy-grass, as being of a class supposed

posed unfermentable; and therefore I repeated the experiment, but with the same result. And since these trials agree with the constant observations of the virtues of this plant, in the marine and marsh-scurvies, it may seem therefore improperly classed with such medicines as correct acidities and promote putrefaction*. As for the asparagus and spinage, tho' they contain but a very 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 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.

But excepting these mentioned, I have made trial of no other esculent plants, since I discovered this their property of fermenting with corrupted flesh. But I remember, when, for some other intention, I had once made a mixture 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

* Both the sea and marsh-scurvies (the only genuine *species* of that distemper) appear plainly to proceed from a putrid acrimony; as the livid blotches, offensive breath, and resolution both of the blood and fibres testify.

could

could not have happened without a previous fermentation. Hence, I conjecture, that all the alimentary plants, not over bitter, or spicy, will be found to 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 †, in a few hours the contents fermented. The intestine motion was considerable, a vast deal of air was separated, and an acid 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 violent fermentation ensued; by which the glass stopper was thrust out, and the froth came over, tho' the bottle was little more than half full. But, since milk may be considered as the juice of grass and various other vegetables, little assimilated into an animal nature, we may judge from hence, how prone all vegetables are to ferment with any thing putrid.

† *Viz.* of 100 deg.

Now,

Now, there being so near a conformity between the contents of the phials, in most of these experiments, and the aliment in digestion, it is scarce to be doubted, but 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, was believed by the chemists; but as they did not explain the manner how, and applied the term fermentation to divers operations in nature, scarcely analogous to that process, it was no wonder their theory was wholly rejected by some, and only admitted by others with many restrictions. Nor shall we infer from any experiment made, that this fermentation is either universal or indispensable; since many live better on a vegetable than an animal diet. And tho' in such cases the vegetables may be said to ferment with the *saliva*, it is plain that this action must be inconsiderable, and come far short of what results from a mixture of animal food. But then we may observe, that without milk, vegetables alone afford but a poor and unwholesome nourishment; and that such as join milk to their vegetables, have in it an animal juice already somewhat prepared. Again, that those who require a vegetable diet most, are either hectic, or of a scorbutic habit; in which condition the *saliva* being in a putrid state, may induce that change upon the aliment,

aliment, which in better health would be effected by the corruption of animal food in the stomach. Without these circumstances, a vegetable diet suits those best, who by great exercise or hard labour are able to subdue the viscidities of unfermented chyle. This is the case of the common people in poorer countries, who subsist chiefly on the *farinacea*, and eat no flesh. But whenever such, by age or infirmity, are laid aside from work, they become subject to indigestions; and, upon the whole, seem to be less healthy and shorter lived, than those that 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 begin much sooner, and probably from the time they are first set in the furnace. Conformably to which notion, we presume, that after every meal, a fermentation is begun, and so far carried on in the *primæ viæ*, that before the chyle enters the lacteals, its particles become as disunited, 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

natural state this fermentation rises ever to a vinous or an acetous height : 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 making it very slow ; and also in checking the too great propensity of animal substances to putrefaction, and of vegetables to acidity. Now, when the *saliva* is found, and in sufficient quantity, and the aliment well prepared and not too much of it, the fermentation passes without any tumult, and generates very little air. But in surfeits, or upon swallowing without due mastication ; when meats are eat tough and fat, or with farinaceous substances unfermented ; or when by any accident the *saliva* is vitiated, too scanty, or not intimately mixed with the food, the fermentation becomes tumultuous, the stomach swells with air, and this extraordinary 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 our aliment, is the best remedy for such indigestions.

3. If

3. If an oily substance is added to the common mixture, a stronger fermentation ensues, which cannot be moderated by the usual proportion of the *saliva*, till some fixed alkaline salt is added, as I found upon trial. And whereas I have also observed, that these salts will, without the *saliva*, not only suddenly stop very high fermentations in the phials, but likewise suppress them for some time, it is no wonder 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 several other stomachic disorders: but I shall attempt to explain only one more at present. This is the *sourness* of the stomach, occasioned by a liquor so very acrid, as to excoriate the throat and set the teeth an edge. 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 very little acid, and still less so when the *saliva* was added. And as for flesh, so far is it from turning sour, that its corruption seems directly opposed to acidity.

Nevertheless it is certain, that many suffer greatly from an acid, tho' living on flesh, bread and water only. Now, from the common notion about 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 having time to undergo a complete fermentation, is thereby changed into a harsh sort of vinegar.

P A P E R VI.

Experiments upon substances hastening, retarding, encreasing, and diminishing alimentary fermentation: with remarks upon their use in explaining the action of digestion; and 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 common bitters. Sea-salt promotes, or retards alimentary fermentation, according to its quantity: but the other septics always hasten that process. In what properties the testacea, lime-water, and the fixed alkaline salts agree and differ. The aliments of the easiest and hardest 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 observations made upon bodies, that either hasten, or retard, increase, or diminish this process. And I shall endeavour, as before, to apply these experiments to use.

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 a 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 a fourth phial were the same materials, only instead of the spirit 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 tea-spoonfuls of rum being added to the common mixture, only retarded fermentation for some hours; tho' probably a double or triple quantity had wholly suppressed it.

2. In one of the common mixtures were infused five grains of the *species aromaticæ*. In another, ten grains of cummin-seed. A third, had half a drachm of saffraſas. A fourth, five grains of saffron. A fifth, five grains of myrrh. And a sixth, five grains of aloes. In the last two the substances were dissolved; but in all the rest, the infusions were

were made in boiling water, and when cool, added to the bread and flesh, together with the several substances infused. Besides these, another phial with the common mixture was prepared for a standard, with which the rest were to be compared, in relation to their manner, time, and degree of fermenting. Things being thus disposed, and the phials placed in the furnace, I observed the fermentation begin in them all much later than in the standard, that with the saffraſas excepted; but with this difference among them, that the mixtures with the aromatics, eſpecially that with the saffraſas, fermented ſtrongly and generated more air than the ſtandard; whiſt thoſe with the ſaffron, myrrh, and aloes fermented ſlower, and were leſs flatulent.

3. In the ſame manner, I examined wormwood, leſſer centaury, chamemile-flowers, gentian root, and green-tea; making moderate infuſions of all except of the laſt, which was ſtrong; and I perceived, that theſe alſo retarded fermentation conſiderably; the chamemile and wormwood moſt: and that all of them, like the former bitters, moderated the fermentation; tho' none of them nearly ſo much as the *ſaliva*.

4. I found the ſame effect in ſtrained decoctions of the valerian-root, and peruvian Bark. But, when the decoction of the laſt was left unſtrained, (*i. e.* with more of the

substance in it) the fermentation became considerably greater than in the standard. Whereupon, recollecting the like high fermentation of the *sassafras*, and what is said of the fermentation of the *Thames*-water in oaken casks*, I ascribed these greater commotions to the aptness all wood has to increase fermentation, when infused with any thing putrid. But, however that be, it is likely that this fermenting quality of the Bark may be the cause of its disagreeing with weak stomachs, when taken in substance and in large doses.

5. In like manner, I examined horseradish, mustard-seed, and garden scurvy-grass, as specimens of the hot *alcalescent* plants; and observed, that the first, like the bitters, suspended the fermentation long, the mustard a little while, but the scurvy-grass not at all. And I took notice, that these mixtures not only fermented more moderately than the standard, but than any of the substances above-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 plants, that after a

* The great disposition in the *Thames*-water first to ferment, and then to purify in long voyages, is well known; and it is probable, that this quality is owing to the extraordinary quantity of putrid matter, with which it is impregnated, at the place where it is taken up by the sailors, *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 peculiarly noted for promoting the fermentation of common vinous liquors.

complete fermentation, the acid thereby produced was considerably milder than that in the standard.

From these experiments it seems evident, that spirits, acids, bitters, aromatics, and the hotter antiscorbutic plants retard fermentation by their power of correcting putrefaction; and since putrefaction and fermentation are such requisites in digestion, that every thing opposing them must be contrary thereto. But whereas, by means either of a putrid *saliva*, or a defect of it, the aliment may ferment too violently; or by a debility of the stomach the food may be detained too long in it, and ferment too much, acids, bitters, aromatics, wines, &c. may have their several uses; some for checking immoderate fermentations, and others for bracing the stomach, and fitting it for expelling its contents in due time.

Fermentation being wholly suppressed in the phials by small-beer, wine, and acids, may seem to argue as if this process would not take place in the stomach, during the free use of such liquors. But, to this we must observe, that the experiments mentioned were made without any *saliva*; for when new trials were made with a sufficient quantity thereof, 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 highly useful, in preventing the more violent fermentations that such mixtures would have produced. But, whenever the recent *saliva* was overpowered by the acid, the fermentation was then to be promoted by correcting that acid, by means of an alkaline salt, or the testaceous powders.

All these facts correspond with digestion. For, the most nourishing and digestible food to people in health, consists in 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, and a debility of the stomach, wines, bitters, warm and acid 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, whenever that humour fails. Of this class are acids, spirits, and bitters; but, as all these very much retard as well as moderate fermentation, they may be frequently less proper than some of the antiscorbutics, which, as we observed, retarded fermentation little, and yet kept it most within bounds*. And, as to the aromatics, however assisting they may be in digestion, by

* Such as mustard, and garden scurvy-grass. Vid. p. 374.
their

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 encrease than to moderate fermentation, and consequently to produce air instead of suppressing it.

E X P E R I M E N T 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 very different from the common opinion about the agreement between an animal and vegetable bitter. For, having added a portion of the gall to flesh, bread and water, and made a standard of a like mixture, without the gall, I perceived the fermentation begin in both about the same time; but to be much stronger, and more tumultuous in the former than in the latter phial. Nay, so little was the gall disposed to restrain fermentation, that without any other animal substance, it fermented with bread and water only, as was 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 surprized at finding digestion so little mended in the jaundice, by
the

the bitters that are commonly given to supply the defect of the bile. There is nevertheless one quality in which the animal and vegetable bitters may agree, *viz.* in correcting acidity: for, I took notice, that tho' the bilious mixtures lost the usual rankness, acquired in the beginning of the fermentation, yet they never smelled nor tasted sour after it was over.

EXPERIMENT XXXIX.

UPON adding sea-salt to the common mixture, I observed, that the same quantity that 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 lye 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.

EXPE-

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 much 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.

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, a liquor resulted, neither acid nor putrid, but of an agreeable smell, like that of new bread.

Thus the *testacea*, lime-water and fixed alkaline salts agree in some things, particularly in subduing acids, 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 do the *testacea*; and being besides of an astringent nature, it becomes an excellent medicine for such as have weak stomachs, with a predominating acid:

acid: as many have experienced, that were subject to the gout, gravel, and other chronic diseases which seemed to depend on that cause.

EXPERIMENT XLI.

ALIMENTARY animal substances, tending to putrefaction, are the only remaining promoters of fermentation, so far as I have enquired. Meat, when kept till tender, tho' yet sweet, becomes a readier ferment than the same kind used quite fresh. But, tho' the fermentation is by this means sooner induced, it is not made thereby the stronger. Flesh pounded in a mortar ferments much sooner, and with less tumult than the same does in a lump, or not sufficiently bruised; and raw meat ferments more violently than roasted. All which are circumstances very consonant to common observation; viz. that meats are much 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 *cæt. par.* also lye heavy on the stomach.

Eggs are among the least corruptible of animal substances, and of course among the slowest to excite fermentation. Hence a new-laid egg, for its bulk, should be of all tender animal food the heaviest; which yet by another theory, regarding the nutrition of the chick only, has been thought of all the lightest.

P A P E R 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 fecal acid. Uses drawn from observing the colours of corrupted blood. Of the nature of purulent matter. Resolution of the blood, relaxation of the fibres, and 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 really putrid whilst the animal lives. The different effects of alkaline salts and putrid substances upon the nerves. That there is properly but one species of the true scurvy; and that this arises from a putrid cause.

Read Feb. 13, 1752. **H**AVING in my last Paper finished that part of my subject, which related 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 blood, and the more solid parts of the body, with a view to clear up some other points in the theory of medicine.

E X P E -

EXPERIMENT XLII.

A PORTION of blood, taken from a man ill of a pleurisy, was divided into the tough 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 of 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 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 had weighed two drachms) lost half of its weight in 24 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, run *per deliquium*: whilst one part of

of the *crassamentum*, (that had likewise been left to evaporate, but upon the outside of a window) formed into a thick cake; and the rest of that substance, which was kept in a close phial, retained a good degree of cohesion for some weeks after.

The inflammatory crust being therefore so soluble, volatile and corruptible, we may 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 those kinds of inflammatory fevers are first brought on by the shutting up of the pores, or from some other cause, has been a question; tho' it has never been doubted, but 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 upon 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 fizy or glutinous portion of the blood, that rises to the surface.

I must add, that tho' the texture of bodies is usually looser in proportion to the quantity
of

of putrid matter which they contain; yet, in this case it is probable, that both the colour and great tenacity of this crust is in a good measure owing to these very particles; since all inflammatory blood, either dropping from the vein, or stirred about before it cools*, or even when received into a very flat vessel, affords little or none of this substance §. For, in all these circumstances, a large surface of the blood, whilst warm, being exposed to the air, the more fugitive particles find means to evaporate, before any part of the mass has time to congeal.

EXPERIMENT XLIII.

MINERAL acids being such powerful antiseptics, I was desirous to see their effects upon substances already putrid. For this purpose, I dropped spirit of vitriol both upon a piece of corrupted beef, and upon the *crassamentum* of human blood, also putrid, and observed, that this acid, instead of allaying the *fætor*, rather increased it; and which by this means became stercoraceous, or was changed into such a smell as arises during the precipitation of brimstone (by an acid) in a lixivial *menstruum* *.

* SYDENHAM. cap. de Pleurit.

§ TH. SCHWENCKE, Hæmatolog. cap. xvi. v.

* Sciendum vero sulphur solutum alcalicis, dein misto acido præcipitari, albescere, *factorem ingratissimum putrefactorum excrementorum* exhibere. — Si tincturæ auræ sulphuris acetum instillas, mox *fætor* prodit *stercoreus* ex præcipitato sulphure. BOERHAAVE, *Element. Chem. Tom. II. Proc. clix.*

Having

Having repeated the experiment both with the spirit of sea-salt and with vinegar, with the same result, we may from thence conclude, that the *effluvia* issuing from corrupted substances chiefly consists 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 combined with the saline parts of the body. For, this principle, 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 rotten substances seem to consist in a certain combination of the *sulphurous* with the *saline* principle, which united not only become the most irritating *stimuli* to the nerves, but act upon the humours as a putrid ferment in promoting their corruption.

From the same experiment it likewise appears, that the *fæces humanæ*, to which this mixture (made between a putrid substance and an acid) has a near affinity, must be compounded of some strong acid and corrupted matter; and from thence, why, in a

|| *Materiam et principium ignis, non ipsum ignem, ego phlogiston appellare cœpi; nempe primum ignescibile, inflammabile, directe atque eminenter ad calorem suscipiendum atque fovendum habile principium. STAHLII Fundam. Theor. BECCHERIAN.*

natural state the *faeces* are so little infectious: which could not happen were they wholly septic*.

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 adding an alkaline salt. But, upon instilling the lye of *tartar* (which was followed by the usual effervescence) I perceived, that the mixture became thereby considerably less offensive, than when the putrid substance was either alone, or joined to the acid: a circumstance I no ways expected. But from hence we may, perhaps, be able to account for the virtues of the saline draughts of *Riverius*, taken in the act of effervescence, and strongly recommended by that author, in vomitings incident to putrid and malignant fevers§.

EXPERIMENT XLV.

IN order to examine the colour of the different parts of the blood corrupted, I procured a fresh quantity without any inflammatory crust, and divided it into the *crassa-*

* See the preceding OBSERVATIONS, Part III. ch. vi. §. 6. p. 297.

§ Vid. RIVER. cap. de Feb. Pestilent.

mentum; 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.

1. 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, dropt a white purulent sediment, and changed into a faint olive-green.

From this experiment we may learn, 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 ferous 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 which may be seen in the colour of the *white* of the eye in deep scurvies, and in the advanced state of malignant fevers. At such times, not only the *serum* of the blood drawn from a vein, and what oozes from a blister, but even the *saliva* and sweat will be tinged in the like manner §.

§ See the preceding OBSERVATIONS, Part III. ch. iv. §. iv. p. 199.

2. To the recent urine, of a person in health, were added a few drops of this putrid *crassamentum*, which it immediately changed into a flame-coloured water, so common in fevers, and in the scurvy. After standing an hour or two, the same gathered a cloud, resembling what is seen in the crude urine of acute distempers: and I took notice of a speck or two of an oily substance, on the surface, like that scum which is seen in deep scurvies.

As to a green *serum*, it is perhaps never to be seen in the vessels of a living body; since, in all putrid distempers, the red globules, being first resolved, enter the serous vessels; and when the *serum* is thus coloured, it never can become green. Besides, as this humour is very 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 of the blood. But, in dead bodies, this *serum* is to be distinguished by the greenness the flesh acquires in corrupting. In salted meats, we commonly ascribe it to the brine, but erroneously; for, that has no power of giving this colour, but only of qualifying the taste, and in some degree, the bad effects of corrupted aliments. This greenness, in dead bodies, is soonest seen in the intestines and adjoining parts, which receive the first taint from the *fæces*.

In

In foul ulcers and in other sores, where the *serum* is left to stagnate long, the matter is likewise found of this colour, and it is then 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 collected in so large a quantity. Of which we had, some time since, almost a fatal instance in Mr. Cox, surgeon at *Peterborough*; who upon tapping a woman, but a few hours after death, was so affected with the poisonous steams of a green *serum*, 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 (long before it grows offensive) becomes turbid, and gradually drops a sediment resembling well 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 all which circumstances, I conjecture, that it is a terrestrial substance, intended for the nourishment or reparation of the solids. And I was the more confirmed in this opinion, upon discovering a like sediment in the urine, of men in perfect health, after long standing;

* Philof. Transact. Abrid. Vol. IX. Part III. ch. v. art. viii.

considering this last as the redundance of the former, or what had been actually applied, but then ceased to be of any longer use.

We may therefore conclude, that the *serum* is perpetually oozing into all ulcers; but, that from the heat of the part, and the natural volatility of animal fluids, it is all quickly evaporated, excepting this sediment, which remains in the sore in the form of *pus*, or digested matter, so requisite for the cure. For this reason, all large ulcers are extremely weakening, from the great expence of blood in furnishing this substance: and hence it is, that issues are of more consequence for making drains, than one would expect from the visible evacuation. 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 in the daily discharge of a large pea-issue, or from a seton.

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 diseases depend-

depending on weak and lax fibres; as it appears in all malignant fevers, and in the true *sea* and *marsh-scurvies*, which certainly arise from a putrid cause.

From this circumstance we are enabled to account for the extraordinary bulk of the heart, liver and spleen incident to these diseases. For, supposing the natural growth stopped by the rigidity of the fibres, balancing the distending force of the blood, it will follow, that whenever the fibres are præternaturally softened, the increase of the parts will begin a-new*. Of this fact we have some remarkable instances in those who died of the last plague at *Marseilles*, communicated to this Society by M. *Deidier*, one of the physicians to the King of *France*§; and 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 those nine dissections referred to, the extraordinary growth of the heart is mentioned in all, and of the liver in seven of them. Thus, in the first, the author takes notice, *that the heart was of an extraordinary bigness; and that the liver was of double the natural size.*—Case 2.

* This supposition from my learned and ingenious friend Dr. SIMSON, Professor of Medicine in the University of St. Andrews.

§ Phil. Transact. abrid. Vol. VI. Part III. ch. ii.

† Traité de la Peste, Partie I.

The heart was of a prodigious bigness; 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 bigness.—Case 6. The heart was larger than in its natural 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 also was larger than ordinary.

As to the scurvy, *Eugalenus*, a celebrated author on that subject, observes, that the liver and spleen were often so much enlarged that the tumour could be seen outwardly*. To these instances I shall add, from my own observation, the extraordinary thickness of the coats of the *colon* in the dysentery, proceeding, as I imagine, from a like cause§.

With regard to the corruption of dead bodies, a very skilful anatomist, who had made an uncommon number of dissections || informed me: “That,

* *Lib. de Morbo Scorbuto, art. xxxi.*

Conf. *MEAD, Mon. & Præc. Med. cap. xvi.*

§ See the preceding OBSERVATIONS, Part III. ch. vi. § ii.

|| Mr. HUNTER, who favoured me with this account, added, that as he had never made any accurate observations on this subject, he could only offer it as the result of his best recollection.

“ the abdominal *viscera* and muscles cor-
“ rupt the soonest, of all parts in the
“ body, after death : wherefore it is a rule
“ with anatomists, to begin their dissections
“ and demonstrations with those parts which
“ first become offensive. That, the quick
“ putrefaction here may reasonably be as-
“ cribed to the putrid steams of the *feces*,
“ with which all those parts are more or less
“ impregnated : hence too the cause of the
“ speedy corruption of the *psoas* and *iliacus*
“ *internus*, in comparison of the muscles in
“ the extremities. That, next to the abdomi-
“ nal *viscera* and adjacent parts, the lungs are
“ commonly the soonest tainted ; whether
“ from the air stagnating in the *vesiculæ bron-*
“ *chiales*, or some remains of the perspirable
“ matter, that may act as a ferment, and
“ hasten the putrefaction. For, whoever tries
“ the experiment of compressing the *thorax*,
“ in a body that has been dead some time,
“ will be sensible of the putrid state of the
“ lungs, by the offensiveness of the air that
“ is forced out of them. That, the brain is
“ generally dissected as soon as may be conve-
“ niently done after death ; because in its
“ firmest state it is but an indifferent subject
“ for the knife, and altogether unfit for dis-
“ section when dissolved by putrefaction ; but
“ that in several cases, he had found it un-
“ expectedly firm after being kept some
“ time, and as sweet as any other part of the
body.

“ body. And that this difference is observable
 “ between the brain and the other parts of
 “ the body, that when kept in the open air, its
 “ putrefaction seems thereby rather retarded,
 “ and it acquires a dry glossy skin on its
 “ outside; whereas all the other parts cor-
 “ rupt manifestly the sooner for being ex-
 “ posed to the air, and get a covering of pu-
 “ trid *mucus* all over their surface*.”

The marrow is commonly accounted a substance the most offensive when corrupted: perhaps from this reason only, that carious bones are more fetid than other sores. But, however that be, I am apt to think, from the following experiment, that the marrow, in general, must putrefy very slowly.

EXPERIMENT XLVII.

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 in all day) in a heat sufficient for liquefying the marrow, that is, above the hundred 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, I should also suspect that the *factor* of a carious bone is not

* This account is fuller than in the last edition.

to be imputed to the marrow; since the corruption of that substance tends more to the rancid than to the cadaverous kind: and, therefore, I am induced to refer that rankness to one of the three following causes, if not to a combination of them all. The first, may be the porousness of the bone, which retains the corrupted matter longer than any ordinary sore. The second, the more constant oozing of vessels conveying the red blood; for, when these are broken in a bony substance, they contract not 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. The last, the ossious matter crumbled to powder, and which being an absorbent earth, may act here like chalk or the *testacea*, and so heighten the putrefaction of the small vessels and matter of the sore.

Having once more mentioned the septic substances, I shall take this opportunity of offering a conjecture about their manner of operating. That there is a latent acid in the composition of all animal bodies, is scarce to be questioned, altho' it may be hard or even impossible to produce it in a simple form. Now, this acid I conceive to be one of the chief ingredients in the cement between the particles that constitute the fibres; and that chalk and the *testacea* act as dissolvents, by being the proper absorbents thereof,

And,

And, as for sea-salt, which is likewise endowed with a septic power, tho' considerably weaker than the former, I likewise impute it to the absorbent part, after the acid is separated. For, there is reason to believe, that animal substances beginning to corrupt, may loosen the texture of the salt; whereupon its acid spirit evaporating, leaves the absorbent substance behind: and this, from the experiments I have made, I imagine must be of a testaceous nature*.

EXPERIMENT XLVIII.

1. IT is well known, that flesh, as well as blood, is specifically heavier than water; and that dead bodies float, after lying some time at the bottom, from air generated in the bowels by putrefaction. But, I have observed, that a bit of meat beat in a mortar to the consistence of a pap, 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 turned any ways offensive: tho' after it rose, the corruption soon became perceptible. Here it is probable, that the particles of air, incorporated with the animal substance†, begin

* Tho' a large quantity of crabs-eyes was dissolved in the spirit of sea salt, yet the liquor remained clear; and when fully saturated, and diluted with common water, had nearly the taste of sea-water. This experiment was often repeated.

† HALE'S Veget. Stat. Ch. yi.

to be disengaged, and so collected together as to buoy up the flesh; tho' at this time there are scarce any air-bubbles to be seen adhering to it.

2. Farther, I have remarked, that both the *crassamentum* and *serum* of human blood have yielded air (after standing some time in the lamp-furnace) before any offensive degree of putrefaction was perceived. This was easily discerned by the accumulation of air in the phials: for, in that heat, the included air, where there is no animal substance, acquires no perceptible elasticity.

3. But, upon the thorough putrefaction of all animal substances, a considerable quantity of air is generated; which being a fact sufficiently known, I shall only add, that I have constantly observed, that a great deal more air is produced from flesh than from blood: which is likewise agreeable to the experiments of the excellent Dr. Hales*.

Now, as I could be assured, that the blood and other animal substances, at the time they began to emit air, were not so far advanced in the septic process, as the same are often found in some putrid diseases, I was induced to think, that possibly several symptoms in deep scurvies might be owing to the action of the air (within the vessels) either wholly detached from, or but imperfectly incorporated with the humours: tho' I was

* Vid. loc. cit.

aware of the objection, that might arise from the experiments of injecting air into the veins, by which animals immediately die with convulsions. For, all we can infer from hence is, that more air is thrown in than is consistent with the circulation; and that if there was less, the animals might survive, tho' perhaps not without some irregular motion of the blood, faintings, a palsy, or slighter affections of the nerves, according to the quantity of the air injected. In fact, we find some of the most accurate naturalists allowing (after trial), that air might be thrown into the veins in a small quantity and insensibly, without killing the animal†. And this is farther confirmed by all the experiments made upon animals inclosed in an exhausted receiver, which begin to swell all over, and are thrown into convulsions as soon as the air is withdrawn; yet recover upon the timely readmission of it*.

† Vena nempe jugularis vivi canis inflatur, proxime coagulatur sanguis, et cito mors sequitur liberum aeris per sanguinem iter. Sed et paucò aëre injecto, neque necatis animalibus, pulsus intermittens fit. (REDI, Vol. VI, p. 223.) Respondit dudum BERGERUS, posse bullas magnas aëris frigore suo coagulare sanguinem, et immeabilitate obstruere vias, neque ideo aeris minimas particulas, sensim et parce admittas eadem mala facturam. HALLER. Not. in BOERH. Prælect. Physiolog. Vol. II. p. 208.

* BOYLE, Physico-mechan. Exp. and in the Phil. Transact. abrid. Vol. II. ch. i.—Mem. de l'Acad. R. des Sc. A. 1700, 1707. MUSSCHENBROEK *Inst. Physic.* §. 1388.

Have

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 access to see the worst cases, that intermissions and irregularities of the pulse are amongst the surest diagnostics of the disease†; that the sick are afflicted with vague and excruciating pains, coming on and going off suddenly, which are always 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 sudden and momentary numbnesses of their limbs, to faintings and swoonings away upon the least motion; and to convulsions and 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 more remarkable upon constitutions of this kind than upon any other, should seem to confirm what has been conjectured, about the looser connection of the air with the blood in scorbutic habits.

Lastly, it may be proper to remove the difficulties of those who maintain, that no animal can live whilst the blood is really putrid; and therefore, that the most to be al-

† EUGALEN. de Morb. Scorbut. Art. xi.

|| Id. ibid. Art. xii. et seq. Art. xxx.

§ Id. ibid. Art. xviii.

‡ Id. ibid. Art. xi. xxvi. xxvii.

lowed,

lowed, is only a tendency to putrefaction. But, to this we reply, that besides numberless observations of the corruption of all the secretions, as 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 no sooner the perspiration by the lungs and skin is impeded, (or whatever other outlet there may be for the more volatile or putrid particles) than a corruption begins in the whole mass; which if not timely prevented, infallibly brings on some putrid disease*.

† Sanguis qui per febres putridas detrahitur, sæpe animadvertitur non solum foetidus & graveolens, sed et putridus adeo ut nec sibi cohærere nec concrefcere 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 foetebat, ut ex ejus tetra odore tam chirurgus quam adstantes in animi plane deliquium inciderent. MORTON, Pyretolog. parte I.

* It has been the opinion of several physiologists, that the blood is kept from putrefaction by its motion only; but for which they could assign no other reason than their observing the greater freshness of running water, and of the sea, when agitated by the wind, in comparison of the same when stagnating. But, here motion seems only to be the accidental cause, by furnishing means to the water for exhaling its more corrupted particles; and in like manner, the circulation can only enable the blood to throw off such matter, as would corrupt it, if retained too long.

bawol

If

If the acrimony is great and sudden, a fever or flux will ensue; but if the accumulation is so slow, that the body grows habituated to the putrefaction, a scurvy prevails. This is the case in long voyages, occasioned by corrupted air and provisions, on board unventilated ships; in marshy countries, from similar causes; and in a lesser degree, in all northerly climates in moist situations, from a want of due perspiration of what is putrid; and especially with the use of salted meats*.

Now, these principles appear to be so plain, that it may seem strange how they should ever have been contradicted: and indeed for this I can only assign the following reason. By some mistake of the chemists, putrefaction in animal substances was confounded with the idea of a highly acrimonious alkaline salt; which being looked upon as certainly destructive to the nerves, the conclusion was, that as no alkaline salt could in that form enter into the vessels, without tearing them to pieces, so the blood never could be supposed alkaline (or putrid) whilst the person lived. But, from the experiments recited in the first of these papers laid before the Society, we find that putrid substances are very different from alkaline; and since the introduction of Mrs. *Stevens's* medicine, we see what large quantities of these acrid salts may pass into the blood without any

* Vid. p. 294, 347, 348.

harm. So different, therefore, are alkaline salts from putrid matter, that the former, of all stimulating medicines, are perhaps the least hurtful to the nerves and blood-vessels; whilst every thoroughly corrupted animal substance is not only offensive to the external senses, but to every nerve and fibre; as is evident from the *nausea*, spasms, palpitations, oppression at the breast, tremors, dejection of spirits and other symptoms consequent upon the admission of any septic ferment into the blood ||.

It will appear, that in all these Papers*, I have considered the scurvy as arising from a putrid cause only, without excepting the *muriatic* species; because salted meats, with too little, or corrupted water, at sea, are also the cause of putrefaction. This was the opinion of *Eugalenus*, an author of the greatest repute, as well as practice, in this distemper, and who lived long in a country extremely subject thereto†. Since his time, among other kinds of that malady, one is said to be owing to an *acid*, a cause so opposite to the former, that tho' the symptoms were more alike, it were to be wished, to avoid confusion, that this supposed *species* had not been called a scurvy. And the rather, as I apprehend, that in the coun-

|| Vid. Observations, p. 182, 298.

* And likewise in the preceding OBSERVATIONS.

† *Viz.* at *Emden* in *East-Friesland*, a sea port town, situated in a flat and marshy country.

tries most liable to the true scurvy, an *acid* is so rarely to be blamed *, that perhaps, we should not have heard of it at all in this class of diseases, had it not been for the celebrated virtues of the *raphanus rusticus*, *cochlearia*, and the like plants, in the cure. For, as all these came to be reputed of an alkaline or putrefying nature, an acid *species* of scurvy seems to have been fallen upon, to account for their action and general use. But, from the experiments laid before the Society §, these *simples* seem to have very different qualities from what some celebrated authors were naturally induced to believe, from attending to their *analysis* only, and to their not being fermentable in the common way of making the experiment.

* Unless in the *primæ viæ*, to which those of a scorbutic habit may be the more subject, on account of the relaxation of the stomach, (see p. 390, 391.) and the higher fermentation of the aliment therein, arising from the corrupted nature of the *saliva* and gastric humours (see p. 358, 370.) But it does not appear that much of this acid enters the lacteals; or if it does, that it is able intirely to subdue the putrefaction of the humours in the true scurvy.

§ Exper. xi. xx. xxxv. xxxvii. 5.



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F I N I S.

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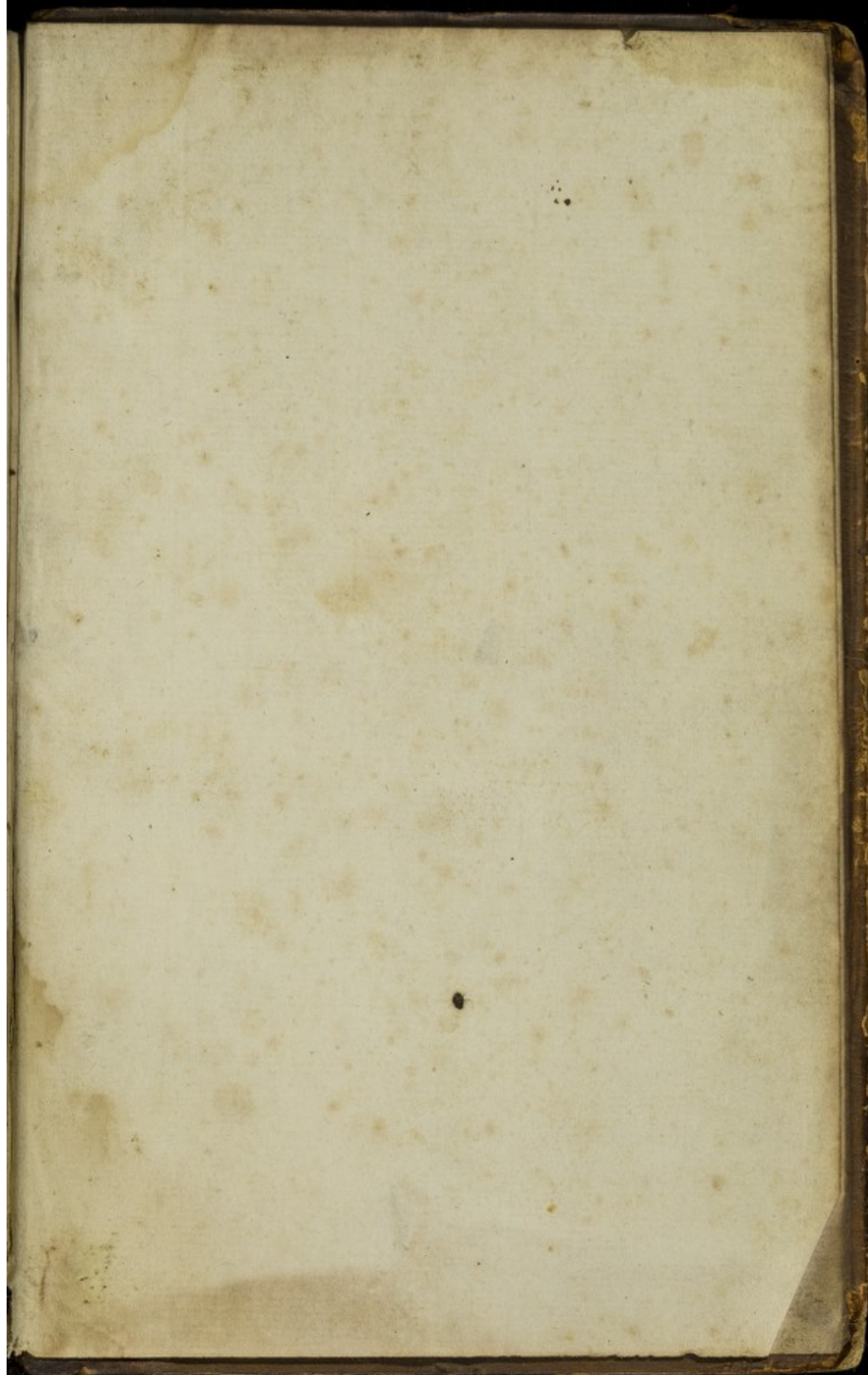
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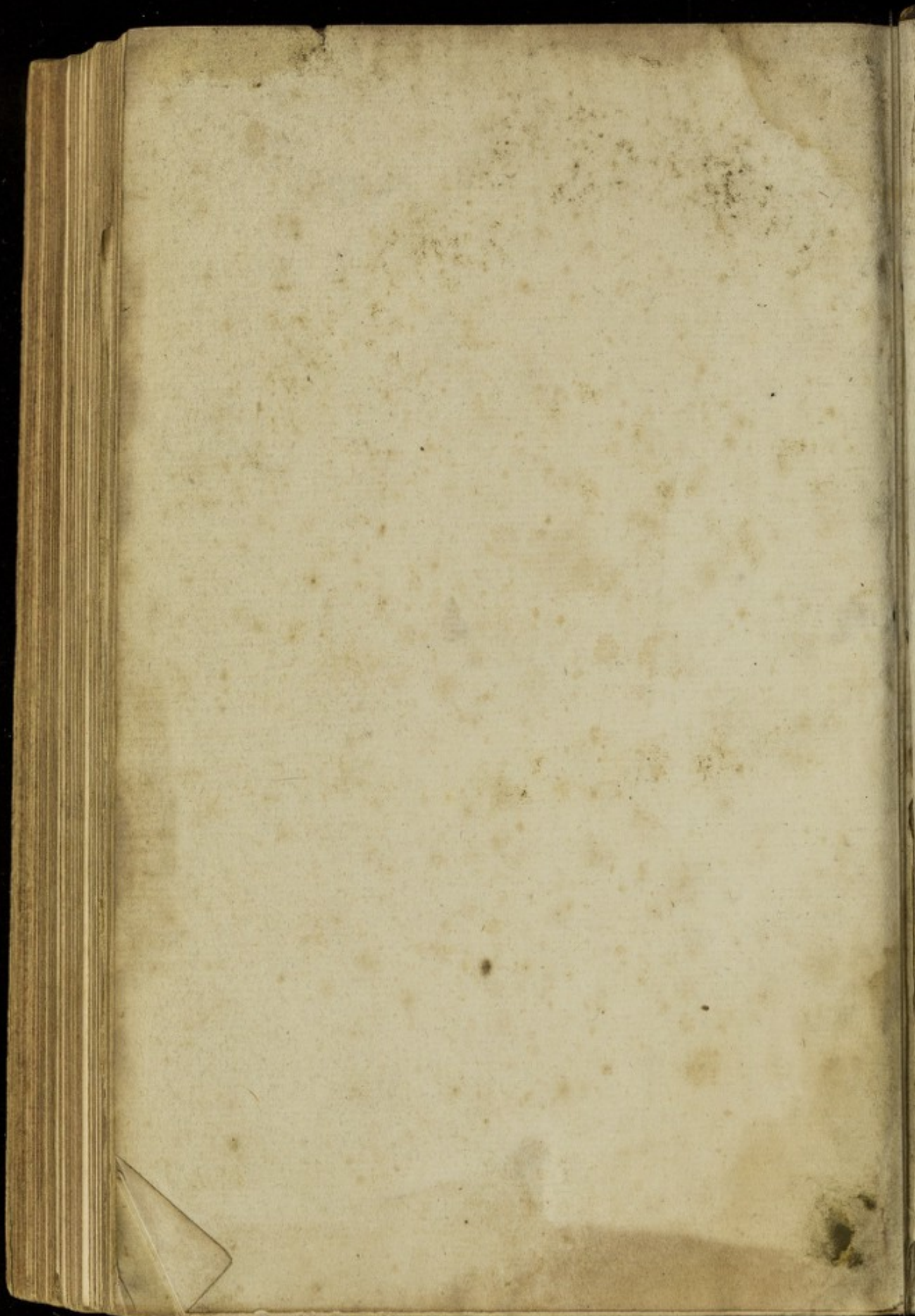
Netherland, why the most unhealthy province of the
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Mr. May here

