

A philosophical and medical sketch of the natural history of the human body and mind ; to which is subjoined, an essay On the difficulties of attaining medical knowledge, intended for the information and amusement of those who are, or are not, of the medical profession : published for the benefit of the General Hospital at Bath / by James Makittrick Adair, M. D. member of the Royal Medical Society, and fellow of the College of Physicians, at Edinburgh.

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Adair, James Makittrick, 1728-1802.
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Publication/Creation

Bath : Printed by R. Cruttwell; and sold by C. Dilly, Poultry, London; and all the booksellers in Bath, &c., 1787.

Persistent URL

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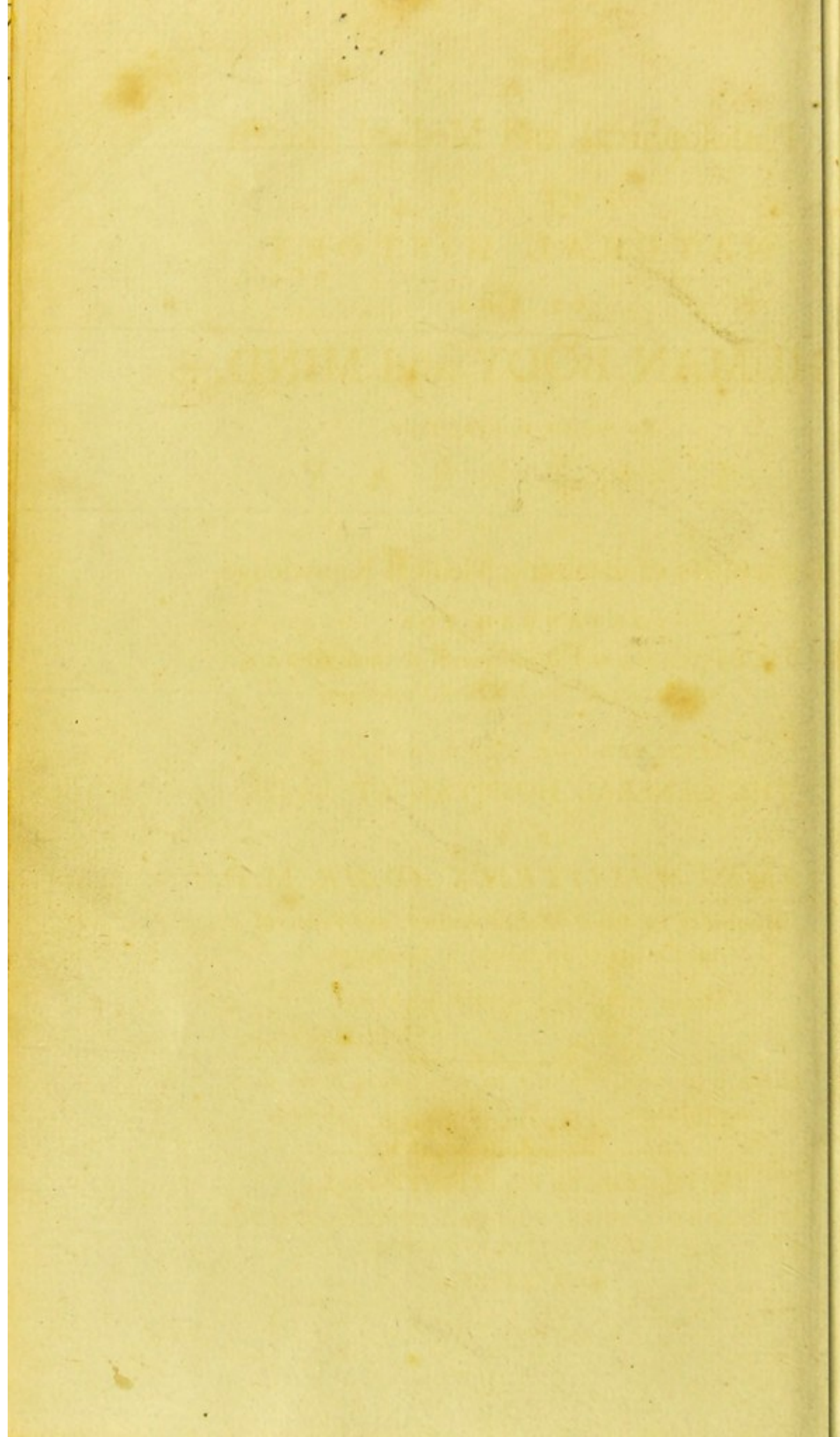
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A
Philosophical and Medical Sketch
OF THE
NATURAL HISTORY
OF THE
HUMAN BODY and MIND.

TO WHICH IS SUBJOINED,
A N E S S A Y
ON THE
Difficulties of attaining Medical Knowledge,

INTENDED FOR
The Information and Amusement of those who *are*,
or *are not*, of the Medical Profession.

PUBLISHED FOR THE BENEFIT OF
THE GENERAL HOSPITAL AT BATH.

B Y
JAMES MAKITTICK ADAIR, M. D.

Member of the Royal Medical Society, and Fellow of
the College of Physicians, at Edinburgh.

Πειρα σφαλερη, κρισις χαλεπη.

HIPPOCRAT.

*Causæ proximæ investigatio ad cognitionem morbi ducit
amplissimam.*

CELS.

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AND SOLD BY C. DILLY, POULTRY, LONDON; AND ALL
THE BOOKSELLERS IN BATH, &c.

MDCCCLXXXVII.

Philosophical and Medical Sketch

NATURAL HISTORY

HUMAN BODY and MIND.

A N E S S A Y

ON THE

Advantages of extending Medical Knowledge

TO THE STUDENTS OF THE MEDICAL PROFESSION

IN THE UNIVERSITY OF BRISTOL

AND IN THE MEDICAL PROFESSION

THE GENERAL HOSPITAL AT BATH.

BY

W. M. WATKINS, ESQ., M.D.

Author of "The Medical Profession," and "The Medical Profession."

London: Printed by J. B. G. & Co., 18, Pall Mall.

1841.

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1841.

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MEDICINE





TO THE
RIGHT HONOURABLE
LORD KINNAIRD.

MY LORD,

THOSE who are acquainted with
your Lordship's Taste for Li-
terature, and Love of Science, will
not receive the following Essays with
less Indulgence, when they are in-
formed,

formed, that your Lordship not only
honoured the MS. with your appro-
bation; but even condescended to
suggest some hints for its Improve-
ment.

I have the honour to be,

With great deference and respect,

Your Lordship's

much obliged,

and most obedient

humble servant,

J. M. ADAIR.



P R E F A C E.

SOME of the purchasers of the MEDICAL CAUTIONS having informed the Author, that the *Essay on Regimen* would have been more intelligible, had the medical reasoning been more clear and explicit; several expedients were thought of to remove this objection, as another edition will very soon be published.

Those authors on regimen, Dr. *Arbuthnot* particularly, who have written for general use, have been obliged to enter pretty fully into a series of medical reasoning; and yet the Doctor, in his second edition, tells us, that his readers complained that he was not always intelligible.

The reason was sufficiently obvious; though the Doctor did not remove the objection. Nothing but a knowledge of the first principles of an art, will ever enable us

to understand any part of it. *Regimen* is a very important branch of medicine, and cannot be understood, unless by those who are previously conversant with the structure and functions of the body.

This consideration suggested the propriety of giving some outlines of the Natural History of the Human Body, so far as was necessary to illustrate the principles of Regimen; as it was conceived that the chief reason why invalids are less disposed to submit to regimen, is their not understanding the grounds of the prescription.

It generally happens, in the execution of a new plan, that more is done than was foreseen or intended.

After the first Essay was in some forwardness, it was thought that a short History of the Human Mind, more physiological than metaphysical, would render the plan more compleat.

This being done, it was found that the functions and operations of the body and mind would be more intelligible, if explained by a reference to their changes in disease; as things are sometimes best illustrated by their contraries.

The

The plan being thus extended, it was deemed more eligible to give a brief sketch and explanation of the morbid affections; as the principles of regimen would thereby be more clearly understood, and the invalids be supplied with a rational plan of regulation, with respect chiefly to diet; and be induced, from conviction, to comply with injunctions, the reasons of which were no longer concealed from them.

As it was proposed to enter more minutely into a detail of regimen necessary for the preservation of health, the physiology was extended accordingly; and what was, at first, intended as a mere outline, has been insensibly augmented into something like a system; which, however, is not sufficiently so as to elucidate those complicated principles which are more immediately connected with medical practice: a more elaborate, extensive, and profound course of study being necessary for those who are to perform the duties and offices of a physician.

When this work was undertaken, it was intended that all the Essays should be comprised in one volume; but it was found that it would be unfashionably bulky; therefore
the

the Essays contained in the MEDICAL CAUTIONS are republished in a separate volume.

But, in this way, the connection between the Essays of this volume and that on regimen will be broken, unless both volumes are purchased: an expence, however, that will hardly amount to the *douceur* of a fashionable hair-dresser.

Another motive suggested itself for publishing this Essay, which was a reasonable expectation that nothing could so powerfully check the present prevailing propensity to empiricism, as a full conviction, which this and the next Essay must afford every reader, that a superficial knowledge of the medical art must render the practice of it very unsafe; and that neither Lady Doctors, nor *venal* quacks, male or female, were possessed even of that *superficial portion*.

It may be asked why, after having, in the most explicit terms, condemned popular medical treatises, as being the chief sources of empiricism, the author should add to the number? He replies, that it will have a directly contrary tendency.

It may be alledged, that if physic be only attainable by a long course of study, its principles

ciples cannot be sufficiently intelligible to answer any good purpose, except to professional men.

But this objection would equally militate against our attempting to attain a *moderate* knowledge of any other art or science.

Does a Gentleman decline learning to dance or fence, because he despairs of so excelling in either as to be able to commence dancing or fencing master? Is the study of astronomy to be neglected, because we may not attain to the profound knowledge of *Newton*, or *Maskeleyne*? Or are Sir *William Blackstone's* Commentaries to be read by none but those gentlemen who intend to follow the practice of the law?

It ought, moreover, to be considered, that no essentially useful knowledge can be obtained without a certain degree of attention, and due exertion of our reasoning powers: a proof that the Supreme Being intended that a frequent exercise of our reason should be the chief means of rendering us wise and happy.

As a curious branch of natural history, several men of science and erudition have deemed the study of the human physiology
an

an useful part of knowledge;^a and though medical men have been suspected of claiming an exclusive privilege to the possession of medical mystery; the following quotation from the works of one of the best men, and ablest physicians, of this or any other age or country, will shew that this supposed professional jealousy is not general; if, indeed, it exist in any degree; which certainly it cannot with any man of candid and liberal sentiments, who comprehends wherein the honour or interest of the profession consists.

“A private gentleman (says Dr. GREGORY^b)
 “ who has a literary turn, and chuses to
 “ study medicine as a curious and interest-
 “ ing branch of natural history, will find the
 “ history of his own species a more interest-
 “ ing subject, than the natural history of
 “ spiders and cockle-shells. To him such a
 “ degree of knowledge is necessary, as may
 “ enable him to understand medical books
 “ of merit, and to judge of the comparative
 “ merit of those men to whom he is to com-

^a From some portion of the Book of *Ecclesiastes*, it is probable that *Solomon*, the wisest of men and of kings, was, for his day, no bad physiologist.

^b Lectures on the Duties and Offices of a Physician.

“ mit the important charge of his own health,
“ and the health of those whom he is obliged
“ by the ties of nature and humanity to take
“ care of. If such men were to claim their
“ right of enquiry into a subject that so
“ nearly concerns them, the good effects on
“ medicine would soon appear. They would
“ have no separate interest from that of the
“ art: they would detect and expose assuming
“ ignorance, and be the judges and patrons
“ of modest merit.

“ Cases very often occur, when an ingeni-
“ ous physician sees his patient hastening to
“ certain death. He knows a remedy that
“ affords a probable prospect of saving his
“ life; but it is uncommon, not agreeable
“ to the established orthodox opinion, and
“ perhaps dangerous in its operation: Here
“ is a dreadful dilemma. If he gives the
“ remedy, and the patient dies, he is utterly
“ ruined. The *dunces*, who are the most
“ numerous in every profession, are always
“ at war with genius, and watch its miscar-
“ riages with an anxious and malignant eye;
“ all his prescriptions must remain on the
“ apothecaries file, and rise up in judgment
“ against him; and upon any miscarriage,
“ the

“ the outcry is raised and propagated with
“ the utmost malignity.

“ The only tame and believing patients
“ are *the men of sense*, who generally submit
“ to their physician, whoever he is, with
“ wonderful faith and patience: while all
“ the midwives, nurses, and old women, are
“ physicians; and the dignity of the most
“ stately of the profession is often obliged
“ to stoop to the folly and caprices of such
“ people, who are sometimes of more consequence in making a physician's fortune
“ than all the merit he can possess.”

A science, it may be said, which may be intelligible to men of learning, may not be so to others.

The experiment has been made: for beside some men of letters, who have perused, and approved of, this and the next Essay in MS. it has been read by several of my female friends, some of them indeed of superiour understandings, and others of plain common sense; and, a few passages of the pathology excepted, (and which a moderate degree of attention would render sufficiently plain) no difficulties occurred in the perusal; whilst the
variety

variety of amusing and interesting anecdotes, interspersed, enlivened the whole.

The History of the Human Mind is peculiarly recommended to the serious perusal of young people of both sexes; and the last chapter of the fourth Book of the first Essay contains a variety of curious and useful information.

The IId Essay, on the *Difficulties of Studying Medicine* is published partly as an useful appendix to the Natural History; but chiefly to impress the reader with a full conviction of a most serious truth; to inculcate which, was the chief motive for this publication.

The author requests that the title may not deter the *ladies* from a perusal of the second essay; some of his female friends having derived both information and amusement from it.

It may justly be supposed, that nothing will be found in either of these Essays that can possibly offend the most fastidious delicacy: an exemption which the *Lady Doctors* may not always enjoy in the perusal of *popular* practical treatises.

The author flatters himself, that his very respectable *sisters* will pardon his attempt to *divest* them of their medical character, as he
has

has *invested* them with one much more important; that of being judges of the degrees of medical merit, and superintendants of the department of *Regimen*; a station as much more honourable than the former, as the rank of a judge is to that of a counsel.

But if all the *cogent* arguments advanced in these Essays are not sufficient to induce the *Lady Doctors* to resign their pretensions to medical practice, they may be assured that a very careful perusal of them will certainly qualify them to read practical books with more advantage; and this volume is recommended as a suitable companion to his volume of Medical Cautions, and Dr. *Buchan's* Domestic Medicine; as in these they will have the most essential branches of medicine united, and be possessed of an assemblage of medical knowledge fully sufficient for *their* purpose.

Whilst upon this subject, the author cannot avoid making a remark on the present whimsical state of physic in this kingdom.

One doctor publishes a very large volume^c, containing, it is to be supposed, a compleat treatise on the practice of physic, by the study of which *every old woman* may be enabled to cure every disease incident to the

^c Domestic Medicine.

human

body, from a nervous fever or a *bilious* colic, to scalded shins and kided heels; *certainly* to the utter annihilation of physicians and surgeons. Another doctor,^d after the most *laudable* efforts to inculcate an opinion that there is nothing well grounded or permanent in medical principles, proceeds to insinuate that *nature* and the *nurse* are the only infallible doctors; though the doctor, *perhaps not very consistently*, subjoins an elaborate treatise on the cure of *those very diseases* which he had previously consigned to the management of the forementioned *venerable* personages. Thus, after one doctor had liberally imparted all his practical knowledge, and another declared there was none to impart; it might have been expected that they would have retired from business, supremely happy in their patriotic endeavours to relieve the public from all future taxation on the score of *medical fees*; yet these gentlemen, it is probable, may still be found in the exercise of their profession. How this happens they alone can determine!

Repetitions, apparently unnecessary, may occur; but they are intended to enforce cer-

^d Dr. Moore's Medical Sketches.

tain important truths; and wherever references are made, it is with an expectation that the reader will recur to them. This recurrence will engage the attention of *fine* gentlemen and *fine* ladies; give their reading an air of study and serious employment, and, by creating *a habit of thinking*, may happily relieve them from that vacancy of mind, and dreadful *Ennui*, from which drefs, balls, routs, scandal, and novel reading, may not always relieve beings who have *just* pretensions to rationality.

To the travelled Gentlemen and Ladies, the author would observe, that were a work on this plan to be published either in *Paris* or *Rome*, it would be read by all who had the least pretensions to *keep good company*; as the whimsicality of its plan, and the singularity of its curious anecdotes, would be commented upon, with great vivacity and *erudition*, at every conversazione and petit soupé in each metropolis; he therefore humbly hopes, that our fashionable *Conoscenti* will not manifest less curiosity than their neighbours.

Having thus, he flatters himself, secured for his work a favourable reception with all people

people of fashion in this realm; he most confidently relies on the countenance of all men of letters, viz. the Members of both Houses of Parliament in both kingdoms, the Members of *all* the Universities, the Bench and the Bar, &c.

But the author is peculiarly assured of having a very numerous class of readers among the *Clergy*, not only as men of learning and leisure; but for reasons he has assigned in the last Essay of the second edition of *Medical Cautions*; and moreover from the consideration that he was incited to the publication of this volume, by a very respectable member of their body.

What shall he say to his medical brethren? It is not likely that the *sage* Doctors will conceive they have any thing to learn at this time of day; yet he is inclined to believe that, *even to the Seniors*, a short retrospective view of the principles of the art may not have any *unfavourable* influence on the practice of it.

A physician of great learning, who read these Essays in MS. is of opinion, that they will be of considerable use, not only to young men entering on a regular course of medical study at the universities, but to a very numerous

rous body of medical practitioners, who never enjoyed such advantage.

Estimating therefore his fellow-subjects of this realm at twelve millions, and allowing the moderate proportion of one in twelve to be possessed either of learning or taste, (excluding midwives, nurses, and quacks, who have neither) the author is sometimes induced, in his momentary fits of patriotic enthusiasm, to form the most flattering calculations of emolument, (not for himself, for he disclaims it, but) for the manifold charitable institutions of this kingdom; and to present to his mind's eye a most glorious prospect, not only of contributing largely toward the support of every public charity, by these his lucubrations, but even of extending his beneficence to the *sinking fund*; which, under the auspices of the present *æconomical* administration, may probably turn out to be one of the most useful of all public charities.

Toward the completion of this great undertaking, he looks up, with a well-grounded confidence, to his *good friends* the Reviewers; who, those of the medical class especially, though they may sometimes be a little parsimonious in the article of critical indulgence,
are

are *never deficient* in the points of candour and impartiality.

The difficulty of selecting, and condensing, from an immense mass of materials, those parts of his subject as were most interesting and amusing, has been greater than can be conceived by those who have never made the experiment; and much labour has been employed in divesting these Essays of technical phraseology, and scientific intricacy; though the author confesses that he has not effected his purpose to his own satisfaction. This remark is not obtruded on the reader to enhance the merit of the attempt; but as an apology for its not having been executed with more precision and success.

From the title, nothing more than a mere sketch is to be expected, sufficient to gratify curiosity, and explain the principles of regimen; but very inadequate to the purpose of qualifying the reader for medical practice; and yet there is reason to believe, that many have undertaken the practice of physic without being even possessed of so scanty a portion of preliminary knowledge; it is therefore to be hoped, that the perusal of this volume, will induce them to have recourse

course to such books as treat the subjects of physiology, pathology, and nosology, on a more extensive plan.

The author has, within a very small compass, given a tolerably accurate explanation of all the morbid affections to which the body is subject; connecting them, on the one hand, with physiology, and on the other, with nosology; in a manner which, he flatters himself, will be found to be equally simple and intelligible, even to ordinary readers.

Though he does not feel himself disposed to insist on his claim to originality of matter, or novelty of manner; yet he flatters himself, that the judicious reader will exempt this publication from the humourous stricture of a celebrated wit,* who remarks, that new books resemble apothecaries' mixtures, which are composed by pouring out of one bottle into another.

He flatters himself that the Ladies will readily pardon *an old fellow* for throwing out some occasional strokes of humour and pleasantry, when he solemnly assures them that, exceedingly anxious as he must be to conci-

* Sterne.

liate their good opinion, he could not possibly intend to give offence; and therefore could have no other motive than merely to enliven a soporific subject.

Whatever may be the merit or demerit of this volume, it will probably meet with some degree of favour and indulgence, when the reader recollects the motives for its publication.



It is a good opinion, he could not possibly
intend to give offence, and therefore could
have no other motive than to satisfy a
curious mind.
The author may be the merit of the work of
this volume, it is probably more rich
foundations of truth and intelligence, which
the author has made his motto, and his
purpose.

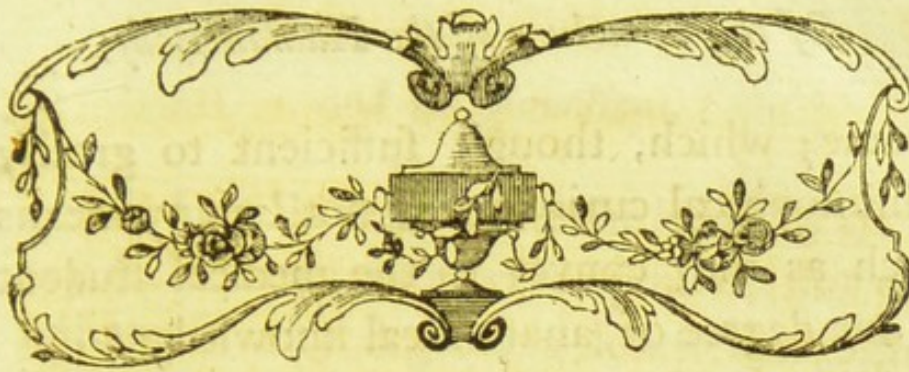
BOOK I

IN THE FIRST PART OF THE FIRST BOOK, THE
AUTHOR HAS GIVEN US A GENERAL VIEW OF THE
HISTORY OF THE HUMAN MIND, AND OF THE
MANNER IN WHICH IT HAS BEEN CULTIVATED
BY THE DIFFERENT NATIONS OF THE WORLD.

CHAPTER I

OF THE NATURE AND EXTENT OF THE
HUMAN MIND, AND OF THE MANNER
IN WHICH IT HAS BEEN CULTIVATED
BY THE DIFFERENT NATIONS OF THE
WORLD.

THE HUMAN MIND IS A
MIRACULOUS ORGAN, WHICH
HAS BEEN CULTIVATED
BY THE DIFFERENT NATIONS
OF THE WORLD.



PHILOSOPHICAL SKETCHES
Of the Natural History of the Human Body
and Mind.

B O O K I.

OF THE STRUCTURE OF THE HUMAN BODY, AND THE
NATURE OF ITS FUNCTIONS.

C H A P. I.

Comparison of Man with other Animals—Division of the Subject—Of the Solids in general—Simple morbid Affections of the Solids—Of the Blood—The constituent Principles of the Solids and Blood—Morbid Affections of the Blood.

§. 1. **I** HAVE remarked in the Preface, that the nature of my plan will not admit of minute anatomical description, but only of a brief and plain account of our
B frame;

frame; which, though sufficient to gratify philosophical curiosity, is not by any means such as may convey to the medical student a due degree of anatomical knowledge.

The structure of the human body is in some points different from that of other animals, though in many respects similar to the formation of some of them, as of those of the monkey and dog kind.

Some whimsical philosophers,^a having considered man as a link of the great chain of animated beings, insinuate, that though our pride has suggested to us that we are *but a little lower than the angels*, we are in truth so very little higher than the brutes, either in form or sagacity, that some of them, particularly the *Ouran Outang*, and the *monkey*, resemble us very much, not only in their outward form and internal structure, but in the degree of their understanding; and this allegation may probably have acquired a greater degree of credit from the daily instances of intelligent horses, knowing dogs, learned pigs, sagacious birds, and musical mice.

^a Swift in *Gulliver's Travels*, and Lord Monboddo in his *Origin of Language*.

But I would not affront the ladies by giving my feeble sanction to this opinion, nor contribute in any degree to lessen the dignity and self-importance of the fairest part of the creation; nor am I much inclined to adopt the hypothesis of the ingenious Governour *Holwell*, lately published, that our bodies are inhabited by the spirits of rebellious angels, and that to the female form and character have been allotted the meekest and mildest; and which consequently have the *least* of the devil in them.

However objectionable this opinion of the Governour's may be, it is nevertheless much more favourable to the ladies, than the illiberal doctrine of Mahometan countries, which alledges that females have no souls; or the hypothesis advanced by some choice spirits of the present age, who are so little disposed to allow that we are even possessed by diabolical spirits, that they divest our natures of whatever may be deemed either spiritual or immortal.

Even naturalists seem, of late, to have given some sanction to the latter opinion, by placing the human species in the same class with the whale, &c. But of all these

systems, it is probable that ladies of rank and fashion will deem the Governour's the least exceptionable; convinced, as they must be, that *Personages of the ton* have an exclusive claim to the virtues of meekness and self-denial, as the genuine fruits of polite education; whilst the middling and lower ranks of females are too much under the influence of rude and untutored nature, to disguise or suppress their constitutional propensities, or conceal the workings of the *dæmoniacal* spirit.

By such an arrangement as the Governour has adopted, much more respectable to the ladies of every rank and denomination than that of the celebrated *Linnæus*, we may place an effectual barrier between man and brute; and I flatter myself it may operate as an additional motive to those of morality and religion; and induce us so far to support the dignity of our nature, that though we may not be able totally to subdue the *spirit* that is within us, we may at least avoid whatever may tend to evince our alliance with the brutes.

Candour, however, obliges me to confess, that of all animals, infant man is the most helpless; and that, in every stage of life, we
manifest

manifest fewer marks of natural instinct or sagacity, than the brutes in general; or even than vegetables; if an ingenious physician^b be not mistaken in the attributes he assigns to vegetable nature.

It may have been ordained by the Supreme Author of our being, that, to compensate for this defect, we should be obliged to exert our rational faculties for our preservation: but it probably was not the intention of infinite Wisdom and Goodness, that, totally deserting nature, we should entirely become the children of art.

§. 2. The natural history of the human body comprehends *anatomy*, or an examination of the structure of the several parts of the body, and *physiology*, or an explanation of the nature and uses of its several organs.

Though the dissection of human bodies has been reprobated by ignorance and superstition; yet, without a very considerable degree of anatomical knowledge, it would be as impossible for a physician to discover and remove diseases, as it would be for a watch-maker to rectify a watch without un-

^b Dr. Percival.

derstanding its structure; and yet quacks of all denominations are so presumptuous as to undertake the task, though totally ignorant of the nature of the human body.

A mere knowledge of the anatomy of our bodies would only be an object of philosophical curiosity, but not of medical enquiry, without an explanation of the offices of the several parts or organs; and therefore there is an intimate connection between anatomy and physiology.

§. 3. All the *Solid* parts of our bodies are composed of fibres or threads, of different sizes and degrees of strength and firmness, curiously interwoven with each other, by transverse threads of a finer texture than the fibres they tie together. The fibres are perpetually bedewed by a fine lymph, to preserve their softness and flexibility. The reader may form some idea of the almost infinite slenderness of an animal fibre, by recollecting that there are some animals so small that they are only visible through a microscope; and yet these must have many organs composed of myriads of fibres.

Some of the fibres of our organs are very delicate and slender, as those of the brain and spinal marrow; others are very firm and rigid, as those which compose the bones and cartilages, or gristles; others are formed into red masses of flesh, called muscles, by which our limbs and other organs are moved; and these muscular fibres also constitute a part of various internal organs, as of the heart almost entirely, and of the stomach, intestines or bowels, arteries, &c. in part; but the chief part of the body, is composed of a fine web-like substance, called *Cellular Membrane*; the threads of which not only unite the muscular fibres with each other, but form the skin and other membranes; and compose the hollow organs of the body, as the stomach, intestines, lungs, arteries, veins, glands, &c. The cavities of the body are also lined with this membrane; it forms the ligaments of the joints, and the coverings of those detached portions of the brain called nerves; indeed it has been supposed by some that even the bones and muscles are composed of these cellular threads in their original formation.

The

§. 4. The simple morbid affections of the animal fibres are various. A fibre may be too gross or too delicate and slender, too hard or too soft, too rigid or too pliable; it may be so stretched as to have its elasticity weakened or destroyed; it may be broken by violence, or its substance may be eroded by various acrid or corrosive causes. These may be considered as the simple or fundamental causes of the manifold diseases of the human body; and as all the solid parts of the body are composed of these fibres, they are consequently liable to all the morbid changes of the simple fibre.

§. 5. The *Blood* is a red glutinous fluid, from whence all the other humours are formed; and as it also supplies the matter from whence the solid parts are formed, the constituent principles of both must be the same.

Oil is supposed to constitute the chief part of the globules, or red part of the blood; it forms the marrow of the bones; the fat lodged under the true skin; in the cellular membrane; in the omentum or cawl, and in other parts of the body.

Water

Water is not only a considerable principle both of our humours and solids, but even of the bones.

Earth not only forms a great part of the solid organs, but is also a constituent principle of the blood and other humours.

The *Salt* contained in the solid and fluid parts of our bodies resembles that which is distilled from hart's horns and other bones, and is called ammoniacal.

These *principles* are derived from our animal and vegetable foods, and our drinks. It is supposed also, that air, a small portion of iron, and fire, are constituent parts both of our solids and fluids.

§. 6. Many diseases were formerly attributed to spontaneous changes of the blood and humours; in many cases they were supposed to be too thick and viscid, in others too thin, acid, alkaline, &c.

The physicians of the present age, more attentive to facts, more accurate in their experiments, and more cautious in their conclusions, without absolutely denying that our fluids may acquire bad qualities; yet alledge that they are rather to be considered as effects than causes, and are chiefly to be attributed

attributed to some previous morbid changes of the organs which prepare, circulate, and secrete them; and as a proof of this, remark, that in those diseases which proceed from infection, as small-pox, measles, plague, malignant and putrid fevers, the nervous system and vital powers are affected, before any manifest change takes place in the fluids. It is not improbable, however, that our humours may be so changed by diet and other causes, as to have some share in the production of diseases. We know that scrophulous and other family taints remain long latent before they break out into disease; but whether they lurk in the fluids or the organs, will not, perhaps, be ever certainly determined.

C H A P. II.

Motion essential to Life—Its predisposing and occasional Causes—Sensibility and Stimulus, —Action and Reaction.

§. 7. **A**S the life of man subsists by a variety of motions, so those motions must be produced by some cause exciting

citing the several organs. This *cause*, which we shall find to be of different kinds, I shall distinguish by the name of *stimulus* or *spur*. When this stimulus acts in a manner consistent with health, it is said to be natural; if it disturbs the body, it becomes morbid, or the cause of disease, and is therefore preternatural.

That the stimulus may excite an organ to motion, it is necessary that the organ have sensibility or feeling; or that there be some quality, by means of which it shall move or react upon the stimulating cause.

The power of the organ to move may be called the predisposing, or constitutional cause; and the stimulus the occasional or exciting cause.

I have chosen this method of explaining the movements of the various organs of the body, because it is simple and intelligible to every capacity; and the reader is requested to hold this explanation in mind, as much use will be made of it in the following chapters.

B O O K II.

OF THE ANIMAL FUNCTIONS.

C H A P. I.

*Of the Functions of the Body, and its Qualities—
How distinguished—The Animal Functions—
Sensation, the Sources and Instruments of it
—Causes of morbid Sensibility—Muscular Mo-
tion—Its Defects—External Senses—Seeing
—Hearing—Smelling—Taste—Touch—Re-
marks on the morbid Affections of the external
Senses—Sleep, its effects—Important Remark.*

FOR the sake of precision, the functions or offices of the organs of our bodies are distinguished from each other; but they are so complicated, that no accurate division of them can be made. They are, however, generally divided into *Animal*, *Vital*, and *Natural*, each of which will be explained when we treat of them.

The *Qualities* are such circumstances as relate to the general aspect or appearance of the body, or of particular parts; as the countenance, eyes, colour of the skin, appearance of the excretions, &c.

The

§. 8. The *Animal functions* are so called, because they are the sources of animation, and of sensation or feeling, and motion.

The *Organs* subservient to the animal functions are:—

1st. The *Brain* situated in the head, and defended by a bony case. Its substance is very soft and pulpy. Anatomists divide it into two portions; the smaller portion, which is placed in the back part of the head, has by some been deemed the chief source of the vital motions. There are several cavities or ventricles in the brain, into which a fine fluid is separated. The brain is supplied with blood by two large arteries; the branches of which are distributed to every point of its substance, in such a manner as to lessen its motion, and break its force, that the delicate substance of the brain may not be injured by the strong vibrations of the arteries.

2^{dly}. The *Spinal marrow* is a portion of the brain, which passes by an aperture in the skull through the neck and back, and is every where defended by a bony flexible case.

The brain is covered with membranous coats, which also descend and surround the spinal marrow.

The

The brain and spinal marrow send off small portions of their substance, surrounded by a part of their membranes.

These portions are called *Nerves*, of which ten pair issue from the brain itself, and thirty pair from the spinal marrow; and those eighty nerves, divided and subdivided into an almost infinite number of small cords, are distributed to every point of the body.

The nerves are not elastic, nor do they shrink or contract, as muscular fibres do, when stimulated. It is supposed that sensation is confined to the pulpy part of the nerve which is derived from the substance of the brain; but that their tough coverings or coats have no feeling, and that when a nerve enters an organ, it throws off its coats, and becomes then qualified to feel.

It has been alledged that the nerves are hollow; but no cavities or orifices have been seen in them with the best microscope.

The brain has generally been supposed to be the seat of the soul or mind; to which some anatomists have assigned an habitation on a small prominence of the brain, called the *Pineal* gland.

The

The brain and spinal marrow are the sources of that faculty which is termed *Sensation* or feeling; and the nerves are the instruments of communication between these organs and every other part of the body.

Though these organs, being the sources of sensation and motion, and consequently of life, may be termed vital, yet there are some animals, especially flies and insects, which survive many hours after their heads are cut off.

Different opinions have been held concerning the manner of nervous communication. The most general is that which supposes the nerves to convey a fine fluid, which, by its flux and reflux from and to the brain, conveys an animating principle to all the other organs; and reconveys to the brain, and through that to the soul, the impressions of sensation in every part of the body.

Some physiologists alledge that the nerves are solid chords, and, like musical strings, perform their office by a kind of vibration.

It is more probable, however, that the electric fluid is the medium employed; as its rapid movements render it peculiarly fit for that almost instantaneous communication which

which takes place between the brain and the other organs.

This opinion is rendered more probable from the power which the *Electric eel* and other fishes have of giving the electric shock; and a very ingenious physician^c informs me that a paralytick patient of his had repeatedly complained to him of sensations similar to those of the electrical shock.

The reader will recollect the principle I assumed in the preceding chapter, respecting irritation and stimulus, which I shall now illustrate by examples.

§. 9. *Sensation or feeling* may be defined a certain consciousness in the mind produced by an impression made on a nerve. But we shall see hereafter that many impressions may be and are made on the nerves of many organs, without being attended with any consciousness of the mind; as in all the organs of involuntary motion.

If we touch a hard body, the impression is instantly conveyed to the brain, and the mind forms an idea corresponding to that impression; and determines whether it is rough or smooth; what is its figure, form, &c.

^c Dr. Falconer.

Grateful foods or drinks excite an agreeable sensation in the palate and stomach, by stimulating the nerves of those organs, and the impression is immediately perceived by the mind.

Baron *Haller* and others have asserted that many organs are totally destitute of feeling; as the bones and their coverings, the tendons, ligaments, cellular membrane, and other membranes of the body (except the true skin) and even the membrane which covers the pupil of the eye; that many of the principal organs, as the heart, liver, and spleen, have much less sensibility than is commonly supposed; and that the muscles and the true skin, and a continuation of it to the tongue, throat, windpipe, inner surface of the stomach, intestines, &c. are the only parts that have a very acute sense of feeling. This opinion has been ably disputed; but even admitting the fact, we know that several of the supposed insensible organs are found to be exquisitely sensible in disease, as in pleurisy, rheumatism, gout, gravel, &c.

The nerves have *ganglions* or little knots formed upon them in different parts of their course from the brain: some have supposed
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that they act as *little hearts* to push on the nervous fluid.

Without sensation we should be mere inanimate machines, and inferiour in the scale of beings even to vegetables; some of which shrink from the touch, as the sensitive and other plants, and thereby manifest a sense of feeling.

There is so intimate a connection between soul and body; and there are such various degrees of sensibility imparted by nature to each; that there is just reason to believe that the praises so lavishly bestowed on stoical indifference, firmness of mind, and contempt of danger, as indications of superiority of soul, have often been misapplied; as these admired qualities seem to be chiefly the result of constitutional insensibility both of body and mind.

Of such impenetrable stuff have many of the heroes and philosophers of every age and country been composed, who, with a different set of nerves, would only have ranked with that lively, pert, and insignificant order of beings, the *petite-maitres* and fribbles.

§. 10. Sensations communicated to the brain through the nerves may be either too
strong

strong or too weak, when compared with the degree of the stimulus which excites them; or the impression made on the mind may not correspond with the nature of the exciting cause; and from one or other of those simple morbid affections, all nervous diseases must proceed. And as the nerves are most intimately interwoven with the other fibres of which the various organs are composed, it is obvious that, besides the simple affections enumerated, (§. 4.) and which are independent of sensation, every sensible organ of the body must be subject to nervous diseases; though the heart, stomach, intestines, and muscles, as being endowed with a greater degree of irritability, are supposed to be liable to them in a more eminent degree.

The change which is made upon the nerves of different organs by their natural stimuli, may perhaps be best understood by the effects of morbid stimulus. Thus if a nerve be pressed upon and stretched beyond its natural tone, or bruised, wounded, or eroded, a sense of pain is produced in proportion to the degree of sensibility, and the violence of the exciting cause. The horrible effects of the rack afford an example equally dreadful and

disgraceful to humanity, of the consequences of irritation in the extreme. Those stimuli which excite either simple sensation, or that which is positively grateful or pleasurable, act probably in the same way as those which produce the various degrees of disagreeable or painful feelings; and the sensation of tickling affords a proof, that the difference between pleasure and pain is only in degree.

It may be proper to remark here, that in all these nervous affections, the fault may be either in the origin of the nerves, in the nerves during their course, or after they have entered into the organ which they animate and move; or, without any previous fault of the nerve, it may be owing to a morbid cause acting upon them: this I shall explain by some examples.

Some persons of delicate temperaments have naturally very irritable nerves, and are therefore easily disturbed by a very slight cause: hence hysteric faintings, and convulsions, from surprise, &c. Such diseases are peculiarly termed nervous, to distinguish them from other diseases which proceed rather from strong irritation than weak nerves.

Were

Were a strong man to be thrown into convulsions by poison or any violent stimulus, we should not say that this patient is nervous; but that he is not destitute of feeling. A person whose nerves are constitutionally strong, may have them so weakened by diseases, as to become what is vulgarly called *very nervous*. Affections from these causes are not so genuinely nervous as the former, because they proceed chiefly from the violence of the cause.

Many diseases proceed from an opposite state of the nerves, viz. Sensibility, and muscular motion, much weakened or totally destroyed. Some of this order of diseases may either follow genuine nervous diseases, or those that have been inveterately painful: thus an hysterical convulsion, or an epileptic fit, often end in a temporary apoplectic stupor; and rheumatism and gout frequently terminate either in a paralytic weakness of the limbs, or an inveterate palsy.

It is not consistent with my plan to enter into a minute consideration of causes; it may be proper, however, to observe, that as the former class of affections proceeds either from excessive sensibility or violent stimulus;

to the latter proceed from sedative causes, or such as either immediately or remotely weaken the sensibility or powers of motion. A stimulant in a certain degree may become a sedative in a higher degree. Thus a spoonful of brandy will stimulate; a pint of the same liquor, if swallowed suddenly, may suspend all sense, motion and life, by bringing on an apoplexy.

The degrees of paralytic weakness are manifold; and besides those of the muscles, many of the muscular cavities and small vessels, as the heart, lungs, stomach, intestines, &c. are more frequently affected by slight degrees of paralytic weakness than is commonly supposed.

Before we finish these remarks on morbid affections of the nerves, it will be proper to take some notice on the extensive influence of sympathy in disease, though scarcely discernible, yet always operating silently, in the healthy body.

§. 11. *Sympathy* is that communication of sensation which is established, through the brain, by means of the nerves, between one organ and another. Some have supposed that particular organs sympathize with each other, without

without the mediation of the brain; and in some instances this may not be improbable. When the cause of disease is in one organ, the sympathetic effect is often extended to another. Thus head-ache, an inflammatory pain of the kidneys, bowels, or gall-duct, often produce vomitings: sickness, from irritation of the stomach by an ingrateful stimulus, may produce head-ache, giddiness and dimness of sight, cough in the lungs, and a sense of sinking, anxiety and palpitation of the heart: worms in the stomach often produce itching of the nose, and puffing of the upper lip: a grating sound in the ear has created numbness of the teeth: tooth-ache has produced blindness, deafness, and loss of speech: a bruise of the thumb has been followed by violent head-ache: a bruise of the toe, a nail run into the foot, and a burn by scalding coffee, have brought on a fatal locked jaw; and tickling has in one person produced fainting, in another epilepsy, and in a third fatal convulsions.

Besides these and many other instances; many of the most distressing, and, to the ignorant, alarming symptoms, in fevers and nervous diseases especially, though sometimes

times in others, proceed from sympathy; by which the genuine nature and seat of the disease is often very much disguised and obscured, and which can only be discerned by men of skill.

§. 12. The *Brain* is not only the source of sensation, but of muscular motion. It may easily be conceived that the brain and spinal marrow, beside all the disorders of the simple solids, (§. 4.) from the delicacy of their texture, the nature of their functions as the grand sources of sensation and motion, and their immediate and most intimate connexion with the mind, must be subject to manifold and important morbid affections: Hence it is, that several of the most violent and fatal nervous diseases originate in the brain or spinal marrow; whilst a multitude of others, those especially which are effects of febrile commotions of the circulating system, make often an early and dangerous impression on the functions of the brain; to which we may add, its manifold sufferings from irregular affections of the mind, and its sympathetic communication, by means of

of the nerves, with all the organs endued with sensation, or susceptible of motion.

It is a curious fact, that though it might reasonably be expected that considerable injuries of the brain must always be followed by great weakness, or total abolition of sense and motion; yet, in some cases, neither have been affected, and the patients have survived, after wounds and imposthumations of this delicate organ, and in one instance after half of the brain was destroyed:—A caution against precipitate prognostic, even in the worst possible cases.

§. 13. The *Muscles* are organs of different forms, by which various motions are performed. They are about 400 in number. Many of them are fixed at each end to bones, by means of white tough cords, called *tendons*; and move the trunk and limbs in a variety of directions: Others are appropriated to the movements of the eyes, the tongue, &c. Besides these, there are internal muscular organs, as the heart, &c.

The manner in which muscles swell, contract, and move the several organs, is truly wonderful; but has not yet been satisfactorily explained. It probably depends on a law

law of the system, which establishes a certain relation between the organ and its natural stimulus; and by which certain impressions must always produce corresponding motions.

When a muscle acts, its fibres are not only considerably shortened, but its belly becomes tense and hard. Every muscle has either its antagonist muscle, or some other counter-acting cause. Thus the various limbs and joints are bended by one set of muscles, and extended by another; the former being generally somewhat more powerful, except those of the head, neck and back. Those muscular fibres which constitute some of the principal organs, as the throat, stomach, intestines, heart, &c. have also their antagonising powers; chiefly their natural stimuli, as will be seen hereafter. During health, there is a pretty exact balance preserved between these opposite powers; but the predominance of the one over the other becomes a very frequent cause of disease.

The rapidity of muscular motion is astonishingly great; the pulse in some fevers is above 150 in a minute; so that the heart must both fill and empty itself in two thirds of a second; and it has been found by experiment,

ment, that 1500 letters may be pronounced in a minute. The progressive muscular motion of animals is exceedingly great, as of the pigeon, the horse, and the dog: even in man it is very great; and we are told by *Thevenot*, that the Persian couriers run 90 miles a day. The muscular strength of some men is almost incredible: *Augustus II.* king Poland could twist and break horse-shoes by the force of his hands; and some men have stopped the motion of two, four, and even six horses, when in full career. Even in diseases, especially madness, muscular exertions are astonishing.

Some celebrated anatomists have supposed that muscles have a power of motion which is independent of sensation, and this faculty they term *irritability*, to distinguish it from sensibility; and it is certain that the heart, and some other muscular parts of animals, move or contract for some time after death, when pricked by a sharp instrument, even after they cannot have any communication with the brain. But, to avoid minute distinctions in a popular treatise, I shall use both terms indiscriminately.

Some

Some phyfiologists have confined the power of reaction, contraction or fpafm, to muscular fibres only, which may partly depend on their fpring or elasticity mentioned above, and partly on their fenfibility; but as almoft all the cavities of the body are partly composed of muscular fibres; fo they are fufceptible of contraction and motion when ftimulated.

Some have conjectured, that the nerves of fenfation and motion are different; becaufe in palsies fenfation is loft, whilst the power of motion remains; and the reverse.

Lefs nervous energy is neceffary for fenfation than for motion; thus dying perfons retain their external fenfes, though totally unable to move: Hence thofe difeafes which are accompanied with lofs of motion are more dangerous than when fenfation only is loft.

Befides thofe fimple affections of the fibres, (§. 4.) and of the nerves, (§. 8.) manifold difeafes of mufcles and muscular organs proceed from various degrees and combinations of thofe fimple affections, and are termed fpafmodic, convulfive, paralytic, &c.

Many wonderful effects have been produced in the nervous and muscular fyftem, which,

which, in ages of ignorance, were attributed to magic, witchcraft, or dæmoniacal possession. Thus from the violent impressions of anger, terror, love, &c. persons have been thrown into dreadful convulsions, seized with extasies, or rendered stiff as statues, often with a total deprivation of sense and recollection.

Nervous affections are sometimes instantaneously communicated from one person to another: thus *Kaw Boerhaave* tells us, that a girl in the orphan-house at Haerlem being seized with convulsions, all the other children who were present were affected in the same manner.

§. 14. The *motions of the body* have been divided into voluntary and involuntary.

The *Voluntary* motions are such as depend on the influence of the will: thus if I will to move my arm, various muscles contract instantaneously, and by their combined power perform precisely that degree and kind of motion which I intend.

Involuntary motions are those which are performed without the direction of the will, as those of the heart, &c.

It

It would have been very dangerous to have subjected the movements of all the organs to the direction of will or mind, the faculties of which are often employed in the various duties of life, or deeply engaged in abstract speculations; and are, in a great degree, suspended during sleep: many operations, therefore, of the animal œconomy are performed without the direction or consciousness of the mind: some extraordinary instances have however been related of persons who had the power of suspending and renewing the motions of the heart at will. Thus St. *Augustine* knew a priest who could, at will, suspend all his senses; and Dr. *Cheyne* mentions a person who could not only suspend all the powers of sense and motion, but renew them at pleasure.

Even the muscles destined to voluntary motion are sometimes contracted without the interposition of the will: thus when asleep, or even when awake, we are often, by a sense of inconvenience or uneasiness, excited to change our posture, and some persons walk in their sleep.

As every organ has its proper stimulus, the will therefore is the stimulus to the voluntary

luntary muscles; and as we proceed, the stimuli of the organs of involuntary motion will be enumerated.

The bones and joints being connected with voluntary motion, it may be proper to offer a few remarks on them in this place.

§. 15. The *Bones*, which, from their firm and rigid texture, afford support to the other solid organs, are of different forms and sizes; many of them are covered with a tough membrane; and such of them as form joints, have their ends covered with *cartilages* or *gristles*, to render their motions more easy, and are united by tough and strong membranes, called *Ligaments*, which, by their pliancy, give the bones a free motion on each other. The bones are not solid, but spongy in the middle; but they are much strengthened by a layer of firm hard plates which cover them.

The muscles, passing from one bone to another, are fixed to each by tendons, in such a manner as to render their movements easy, quick, and sufficiently powerful. The various combinations of the muscles in performing the different motions of the neck, back and limbs, are exceedingly curious.

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The bones and ligaments are subject, not only to all the diseases of the simple solids, (§. 3.) but to some which result from faults of secretion.

Thus the bones may be so brittle, as to be easily broken, their substance may be eroded and corrupted; and in some instances, bones have become so soft, as to be totally unable to sustain the body. The ligaments may be too lax or over-stretched; hence luxations; or they may become so rigid as to render the the joints inflexible, &c. Some soft organs acquire the rigidity and firmness of bones.

Whilst we are on the subjects of sensation and motion, it may be proper to consider the senses of seeing, hearing, smelling, taste, and touch.

§. 16. The *Eyes* are of an oblong spherical form, consisting of different layers of coats or membranes; containing, in different chambers, the watery, glassy, and crystalline humours. The eyes are amply supplied with nerves; the chief of which, termed the optic, are spread upon the retina. Several muscles are employed in moving the eyes in a variety of directions, for the purpose of enlarging
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the field of vision: The force of the rays of light is partly weakened by the eye-brows and eye-lids.

The eye is an organ so necessary to the preservation of animals, that few, even of insects, are without it. Some shell-fish have eight, and flies &c. have five; but notwithstanding the story of the Cyclops, it is not probable that any animal has less than two. The surface of the eye is perpetually moistened by a fine fluid, which is conveyed into the nostril by a duct. Its passage is sometimes interrupted by the influence of some passions, especially grief and joy; and it flows down the cheeks in form of tears: it is remarkable that horses, deer, and dogs, also shed tears.

It would be impossible, consistently with the nature of my plan, to enter on a scientific consideration of vision; to explain which, the theory of optics, a very curious and complicated branch of philosophy, must previously be understood.

I shall only remark, therefore, that the rays of light reflected from objects of vision, passing through the pupil, and refracted by the humours of different degrees of density,

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fall upon the *retina*, a very sensible membrane at the bottom of the eye, where the image of the object is painted, though in an inverted position; and by the impression made on the nerves of this membrane, it is conveyed through the brain to the mind, which forms a corresponding idea of its colour, dimensions, distance, &c. *Light*, therefore, is the natural stimulus of the eye. When it falls on the eye in too great a volume, the pupil, stimulated too forcibly by its vivid rays, contracts, and excludes a portion of them, as happens always when we pass suddenly from a weak to a strong light; and, on the contrary, the pupil expands in a weak light, that it may admit as many rays as possible.

Though light resemble fire in some of its properties, there are some circumstances in which they are different.

The velocity of light is amazingly great; as its rays, issuing from the sun, pass through a space of above ninety-five millions of miles to our earth in eight minutes and thirteen seconds.

It was reserved for the genius of the immortal *Sir Isaac Newton* to discover that the
rays

rays of light are each divisible into seven fundamental colours, and that those colours are not, as is vulgarly supposed, inherent in the objects; but that the different colours of bodies proceed entirely from their texture, which disposes them to refract one colour of the rays rather than another.

It is a singular circumstance, but confirmed by experiments, that white is formed by an union of the seven fundamental colours; and as the rays of light are white, so they are divisible into the different colours of which they are composed, by means of a prism. The judgment we form of the qualities and distances of the objects of vision would be very erroneous, were it not corrected by experience; hence the deceptions of infants, and the astonishment of a young gentleman, who, being born blind, recovered his sight by couching; and found himself deceived with respect to those things which he saw, and which he had formerly known by the touch only.

The eyes of some persons are said to have emitted such luminous splendour in the dark, as to render objects visible to them. This has been related of *Caius Marius*, the

Emperours *Augustus* and *Tiberius*, and others; and the celebrated *Julius Scaliger*, and *Theodore Beza*, have asserted, that they could by this means read books in darkened room.

New-born infants are blind for some time after birth, and this also is the case with some other animals: a wise provision of nature against the injury which so delicate an organ would sustain by a sudden glare of light.

There are several natural defects of vision. In persons who are short-sighted, the globe of the eye is more oval than ordinary, and therefore the distance between the pupil and the retina is too great, and the images of the objects are not sufficiently distinct. Such persons are in some measure benefited by concave glasses. Others, on the contrary, see distant objects well, but not those which are near and small: this defect happens most frequently in old age, and is remedied in some degree by the use of convex glasses.

Some persons cannot see in a weak light; this is called night-blindness, and is owing to the nerves of the retina not being sufficiently sensible: a contrary defect proceeds from such extreme delicacy of the nerves of the eye, that they are too forcibly stimulated by the rays of light.

§. 17. The *Ear* is a curious and complicated organ. It consists of the external ear, which resembles a segment of a circle; a winding passage leading to the drum, which is a membrane stretched across the passage: some very small bones annexed to the back of this membrane by muscles; and a cavity beyond these, lined with a membrane, supplied with a considerable nerve which renders it very sensible: this cavity terminates in a tube which opens into the back part of the mouth.

The external ear is supplied with muscles; and which in some animals is moved by them in various directions, for the more ready admission of sounds. Some men have had the faculty of moving the external ear, and their hearing has been more acute on that account; the pressure of the ears during infancy prevents us from enjoying that advantage. It has been supposed by some that there is a communication between the external ear and the passage or tube which opens into the mouth, from some persons being able to breathe through the ear, and even force the smoke of tobacco through it; but in these cases there was supposed to be a preternatural opening in the drum.

The drum is covered with a mucus in infants, which breaks the force of sounds; and which, if too acute, would exceedingly disorder their very irritable nerves, and throw them into convulsions.

Sound is the natural stimulus of the ear. Its rays are collected and concentrated by the external ear, pass through the tube, strike more or less forcibly on the tympanum or drum; which, being elastic, vibrates, and produces an undulation of the air contained in the inner cavity, by the impulses of which on the nerves of its lining membrane, corresponding impressions are conveyed to the mind.

Sound is a tremulous motion impressed upon the air, which agitates the minutest particles of the bodies it acts upon. Bodies are more or less sonorous, according to the degree of their elasticity; hence musical instruments and strings are always constructed of elastic materials; hence we can account why some persons break wine-glasses by the voice.

Sound moves with the celerity of 1200 feet in a second. It is communicated through water, and more solid substances;
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for the Abbe *Nollet* heard a person speak when he was 18 feet under water; and a person at Halle, by putting his ear to the ground, heard the noise of the cannon fired at the battle of *Rasbach*, though many miles distant. From the communication of the ear with the mouth, we can account why deaf persons can hear when a slip of board is placed with one end on a musical instrument, and the other between the teeth; and we are assured that a deaf person *heard* what was written on her back or arm.^a

It has been alledged that the progress of sound is not retarded by the strongest wind blowing in an opposite direction, but this may be doubted; it should seem, however, that it is affected by the rarity, density, and elasticity of the atmosphere: hence sounds are stronger in summer than winter, in hot than cold air, and when the sounds are directed against a wall. *Echo* proceeds from the reverberation of sound. A bell does not emit any sound in an exhausted receiver.

^a “ Quæ scribebantur super brachium dorsumve surdæ virginis, ea recte audiebat.”

Halleri Element. Physiolog. vol. v. p. 254.

Much has been attributed to the influence of ancient musick on the passions; and even in more modern times, instances are recorded of its power over the mind. *Amurath* the IVth, Emperour of the Turks, a cruel and unrelenting tyrant, having condemned several of his brothers to death, was so affected by the musick of the harp, as not only to pardon them, but even to shed tears of compunction. The cure of the bite of the tarantula is fabulous only with respect to the cause of the disease, which is a species of melancholy.

It has been asked how it happens, that as we see with two eyes, and hear with two ears, we only see objects, and hear sounds singly. The most easy solution of the question is, that the mind does not distinguish impressions made on it through the external senses, when they are very similar; and that custom and experience may contribute to regulate the judgment in this respect.

The sense of hearing is exceedingly and painfully acute in some persons. A celebrated Professor was much distressed even by the gentlest sounds, and such as were not audible by others: In diseases, as nervous fevers,

fevers, phrenzy, hydrophobœia, locked jaw, and the hysteric disease, &c. the sense of hearing is often intolerably acute.

Some sounds are universally grating to every ear, as the rasping of a file; some persons are peculiarly disturbed by particular sounds, owing to a depraved state of the auditory nerves; and indeed to depravity of one or other of the external senses in diseases, we may attribute many extraordinary and untoward symptoms.

§. 18. The *Nostrils* are the organs of smell, and *Odours* are their natural stimuli. The cavity of the nostrils is lined with a very sensible membrane amply supplied with nerves, which being stimulated by odorous effluvia, convey the impression to the mind.

There are few bodies in nature that have not a peculiar odour; even gold, in a state of solution, has a musky smell. The subtilty of odours is almost inconceivable. One grain of ambergrise scented many volumes, and the smell was not much diminished after forty years. Odours are extended to a great distance; a dog traced and followed his master an hundred leagues from Paris, directed by
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the peculiar smell of his perspiration; and after the battle of Pharsalia, the vultures were allured from a great distance by the putrid effluvia of the dead bodies. The effluvia of purging medicines sometimes purge; and strong odours have been fatal, by discharging a great quantity of phlogisticated air: hence the danger of keeping flowers and fruits in close rooms. We know that certain effluvia are stimulating to a considerable degree; hence the use of volatile salts in faintings. Effluvia may in some cases be nutritive. *Democritus* is said to have kept his sister alive three days by the smell of new bread.

From some peculiarity in the state of the olfactory nerves, or from habit, some persons, and even nations, are gratified by particular flavours, which are generally disgusting. The inhabitants of Greenland are fond of train oil, and the most rancid fat: the most putrid meats are not offensive to particular persons: the ancient Romans held the *garum*, prepared of the putrid livers of fishes, to be an extraordinary delicacy.

Brutes select their foods rather by the smell than the taste, and yet they are sometimes deceived by this test.

§. 19. The

§ 19. The *Organs of Taste* are the tongue and palate. The *tongue* is supplied with considerable nerves, the ends of which form little prominences or papillæ on the surface of the tongue, especially at the tip and sides.

The natural stimuli of the organs of taste are all *sapid* bodies, so called in opposition to such as are insipid or tasteless. Sapid bodies do not affect the tongue except in a liquid state. Though this organ is very irritable, yet jugglers lessen its sensibility so much by a solution of alum, which is a powerful sedative, as to be enabled to lick red-hot iron, and hold burning coals in their mouths.

The sense of taste is supposed to be useful in distinguishing wholesome from noxious foods; but this is not always the case; for the agreeable taste of the Manchionille apple has induced strangers to eat this poisonous fruit; seamen have been poisoned by eating a fruit resembling the nutmeg; and animals endued with an exquisite sense of smelling and taste, have been poisoned by noxious plants.

There is an intimate connection between smell and taste; so that what is grateful to the former, is seldom disgusting to the latter.

Things

Things grateful to the smell are not however always so to the taste; and indeed many things which are highly odorous, have scarcely any taste, and the reverse. Sometimes the smell is very grateful, when the taste is very disgusting, and the contrary. What was remarked concerning depravity of the sense of smelling may be applied to taste: some natives of India cannot relish eggs unless they are rotten; the Esquimaux prefer putrid fish to those that are sound. The longings for chalk, coals, &c. are effects of disease.

§ 20. *Touch*, strictly speaking, is confined to the ends of the fingers; the nerves of which are, like those of the tongue, collected into little prominences, for the purpose of more acute feeling. It has been positively asserted, that blind persons can distinguish colours by the touch; and that a blind woman could know when they were mixed.

The whole surface of the body being covered by the true skin, which is very sensible, its sensation, though not so accurate as that of the ends of the fingers, is sufficiently so to warn us of the noxious impressions of heat,

heat, cold, &c. When the heat of the bodies we touch is greater than the temperature of the human body, which is about 96 degrees, they excite the sensation of heat; if below that degree, the sensation of cold.

The true skin would be intolerably irritable, were it not covered by an insensible scaly substance called the *scarf* skin. The surface of the body is also defended in some parts by the nails and hair, which are destitute of sensibility.

The scarf skin not only covers the true skin on the surface of the body, but also the continuation of it, which lines all the cavities of the body, and forms what is called the villous or inner coat of the stomach and intestines; and becomes in some degree a defence to the nerves of the true skin against the acrimony of foods, drinks, &c.

It is very thick and hard on the soles of the feet, and palms of the hands of laborious persons; insomuch as to enable them to handle, or walk upon burning coals, or red-hot metals.

It is a layer of the scarf skin, called the *reticular* membrane, which produces difference of colour in different nations. Some have

have asserted that this difference is the result of climate alone; but no instance can be produced of an European in a hot climate becoming black, or a negro becoming white in a cold or temperate climate: the distinction is original, and impressed by the hand of nature. Sometimes the child of black parents has been born of a white colour; but this is a mere error of nature.

The nails are a continuation of the scarf skin condensed; they grow after death, and in the embalmed body of a young lady who died above 250 years ago, they are cut every year.

The difference of the colour of hair seems to be owing partly to climate; in the original natives of hot countries it is black, and in the Africans wooly and curled.

The sense of feeling is very exquisite in some persons. The celebrated Queen of France, *Ann of Austria*, could not sleep in the finest linen sheets, which to her feeling were coarse and rough; and therefore was obliged to use sheets of cambrick. The sense of feeling is sometimes depraved. Some persons cannot bear the touch of velvet, others of the downy peach; and I knew a captain
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of a ship of war to whom the touch of hair was intolerable.

The eastern nations consider the means of exciting pleasurable sensations as an article of *luxurious* indulgence. Besides the pleasure of *champow*, well known to our British nabobs, the Chinese excite a very pleasurable sensation by tickling the ear with a fine hair pencil.

The sense of touch is supposed to be the least fallible, and corrects the errors of sight.

There is an internal sense of feeling which has some relation to the external sense of touch; but which is more diversified; inasmuch that every organ seems to have a sensation peculiar to itself. The internal sensations are however very indistinct; and hence we are often liable to be mistaken with respect to the real seat of diseases, if we do not attend carefully to the influence of sympathy, either general, or that which is established between one organ and another; as between the head and the stomach, the stomach and the heart, and of the lungs, kidneys, and intestines with the stomach.

Though disagreeable or painful sensations may be excited in the other organs of sense,
as

as well as that of touch; yet they more peculiarly belong to this sense; and though, strictly speaking, it is confined to the ends of the fingers; yet, in the more general acceptation, it is applicable to the sense of feeling, which is very extensive.

There is, as I remarked before, but a very thin partition between a pleasant and a painful sensation, and in many respects they are rather relative than positive: thus a degree of stimulus which would give pleasure to a man of callous nerves, would produce painful sensation in a more delicate person.

It may be truly said that even in health, we are rarely free from disagreeable feelings; though from their frequency, and being but comparatively slight, the mind is not always conscious of them: thus we often change our posture unconsciously, from a sensation of uneasiness.

§. 21. It is ordained by the Author of our nature, that all noxious impressions made on our bodies should be accompanied with a disagreeable or painful sensation, which might warn us of our danger, and rouse us to a sense of the necessity of using adequate means for our relief.

Thus

Thus inflammation of an organ is accompanied with pain, by which we are excited to prevent a fatal mortification; in which sensation is destroyed. Hence it is that even our sufferings become the means of our safety.

§.22. When we consider the very complicated structure of some of the organs of sense, especially of the eye and ear, and the intimate connexion of the others, not only with each other, but with other organs, we can easily account why their affections and diseases are exceedingly numerous. Beside those which they are subject to in common with the simple solids, (§. 4.) there are others which result from the nature of their several functions, and which may be briefly referred to excess, defect, or irregularity of each sense; and which besides the general causes, are often connected with various faults of circulation, secretion, and excretion, to be enumerated hereafter. Many perversions of the senses proceed, not so much from any fault in their proper organs, as from those of others: such are, various and extraordinary deceptions of vision and hearing from diseases of the head and stomach; and morbid

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affections of the taste and smell from the same sources: but above all, those of the external and internal sense of feeling are so numerous and extensive, that there is not a disagreeable, painful, or distressing sensation, which may not be derived from excess or depravity of this sense; whilst a defect, or total deprivation, of it is connected with many of the most inveterate and fatal diseases.

From what has been said on the animal functions, the nervous system may be aptly compared to the sun in our planetary world; as it sheds its influence to the remotest recesses of the body, diffuses the living principle to every particle of the sensible and moving organs, and animates and invigorates the whole machine.

Before I dismiss this branch of physiology, it may not be improper to remark, that as exquisite sensibility of body and mind (for they are generally concomitant) is the chief source of our greatest pleasures, it is no less so of our most poignant sufferings; and it is worthy of observation, that the organs are not all equally affected by the same stimuli: A glare of light does not offend the ear, nor strong sounds the eye: a solution of emetic tartar

tartar will not affect the eye, though in the stomach it creates severe nausea; and air and blood, which are natural stimuli to the lungs and heart, are offensive to the stomach.

§. 23. *Sleep.* All animals, even fishes, are supposed to spend part of their time in sleep.

It is probable that they sleep constantly, or with little interruption, before birth: we know that infants are rarely awake for some months after birth.

Animals, beasts of prey excepted, generally sleep from sun to sun, and several sleep through the winter.

The laborious part of mankind enjoy the genuine luxury of sound sleep, whilst the studious, and fashionably dissipated, *murder* sleep, by inverting the order of nature.

Old persons, like infants, require more sleep than the young and middle-aged; who, whilst in health, ought not to sleep more than eight hours in twenty-four.

We should soon be exhausted by the constant exercise of our bodily and mental functions, were we not relieved by sleep. During sleep, the vital and natural functions are performed more slowly and regularly

than when we are awake; the faculties of the mind are in a great degree suspended, and the muscles of voluntary motion are at rest. Hence, after a sound sleep, we awake alert and vigorous.

Excess and defect of sleep are very injurious both to body and mind: Want of sleep is a very frequent concomitant of diseases; and there are many instances of persons sleeping for weeks and months; and one person slept four years with very little interruption.

Some persons, whilst in a sound sleep, get out of bed, dress themselves, light a fire, write, undress themselves; go into a bath, &c.; and some years ago a young gentleman happily acquired a valuable wife, by a beautiful young lady of large fortune having, in one of her *somnambulous* peregrinations, gone into the bed in which he, as a guest, lay; the room being supposed to be haunted, from the young lady's having long been in the habit of removing from her own bed to this: May we not charitably suppose, therefore, that many of the occasional deviations of the ladies, both single and married, by which they mistake one bed for another, are solely to be attributed to an unlucky propensity

sity to walk in their sleep? I flatter myself, at least, that due credit will be given me for the *ingenuity* of my apology for female frailty.

Want of sleep is a most distressing, weakening, and dangerous symptom, in a multiplicity of diseases. The causes of morbid irritation, which produce and support this dreadful evil, are many and complicated; and it is of the utmost consequence that the true cause should be well ascertained, and that it may be safely and speedily removed. In no instance do ignorant practitioners err so much, and so frequently, as in cases of this kind. The timid are deterred from using the necessary means; and therefore lose many patients, which the man of skill would have saved; whilst, on the other hand, the rash and presumptuous destroy many by improper means.

The importance of the remark must be my apology for its being out of its proper place; for no circumstance, in the whole extent of medical science, evinces more strongly the danger of a superficial and imperfect knowledge of the nature and causes of diseases.

C H A P. II.

The Natural History of the HUMAN MIND.

The Internal Senses—Perception—Ideas of Sensation—Of Reflection—Attention—Memory—Morbid Affections of Memory—Succession of Ideas—Notions—Association of Ideas—Imagination—Reminiscence—Thought—Judgment—Reasoning—Genius, or Invention—Truth—Error—Morbid Affections of the Mind respecting Truth and Error—Delirium—Madness—Melancholy—Hypochondriacism—Idiotism—Pleasure and Pain—Appetites—Depraved Will—Voluntary and Involuntary Motions—Nature—Passions—their morbid effects—Imaginary Diseases—Important Remark.

§. 24. **F**ROM the connexion between mind and body, the internal senses are objects of physiology, and they properly come under our consideration, after the external senses. I shall therefore here present the reader with a superficial, yet interesting, sketch of our mental faculties.

It is surprising that, whilst the mind of man is so anxiously employed in investigating
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the nature of external objects, it should not be more solicitous to understand its own faculties and powers; and that we should be more deficient in this branch of knowledge than in any other.

The metaphysical disquisitions of philosophers would certainly be very much assisted by a more frequent dissection of persons who die mad; idiots; or those who were remarkable for failure of memory.

§. 25. *Perception* is an impression conveyed from the external senses to the brain, by means of a certain change or motion on an external sense.

§. 26. *Idea* is a consciousness or recognition of the motion excited in the brain by a particular object, and imparted to the mind, in a manner which we cannot account for.

Some have imagined, that the picture of an object painted on the retina is also painted on the brain, and is thus perceived by the mind; but it is now more generally believed, that all external impressions made on the nerves of the organs of sense, excite perception in the mind, by merely producing a
corre-

corresponding motion or change in the brain; so that an idea is only the sign of the impression, and not the impression itself.

Ideas are either *simple*, as those which are excited by our seeing one colour only; or compound, as when I view a man, I conceive the complex idea of his head, limbs, colour of his clothes, &c.

Ideas may also be divided into those of *sensation*, being impressions made through our five senses; and those of *reflexion*, being such ideas of sensation as present themselves to the imagination, or are recalled by the memory; as when I perceive *in the mind's-eye* the *person* of an absent friend, or recollect when and where I saw him last.

Mr. Locke asserts, contrary to some foreign philosophers, that we have no innate ideas; but that the mind of a new born infant is a mere blank; and that our ideas are formed from impressions received through the eye, ear, &c. I have already remarked, that ideas of reflexion are derived from those of sensation. Our senses do not impress the brain with the same perception of the same object; and it is only by experience that the mind forms a true idea of its qualities: An infant,

or a person born blind, who had been restored to sight, when they view a portrait for the first time, will conceive that it projects from the canvas, until by the feel they find it does not.

The celebrated *Mr. Boyle* tells us, that a man who was born blind, and consequently could have no just idea of colour, being told that scarlet was a vivid and splendid colour, expressed his idea of it, by resembling it to the sound of a trumpet: Thus a deficiency of one sense rendered the idea imperfect and absurd.

It is therefore reasonable to suppose, that if we had been endowed with other senses than those we have at present, our perceptions and ideas would have been very different; for there is no absolute necessity in the nature of things, that we should not perceive or know things otherwise than we do at present; or, having other senses superadded to the present, we should not perceive the magnetic, electric, or aerial fluids, as clearly as we now do water and fire. So on the other hand, light and colours are to the blind, and sounds are to the deaf, as if they did not exist; because they are incapable of receiving any ideas from them.

In

In contemplating the objects and circumstances of perception, we are to consider them in a certain order.

1st, The external object, with its genuine attributes: *e. g.* a tree.

2dly, Their impressions on the organs of sense; the picture of a tree, painted on the retina, at the bottom of the eye.

3dly, The corporeal effect of those impressions conveyed to the brain: as when the image of the tree makes a corresponding motion on the brain.

4thly, The representation or idea of this motion conveyed to the mind.

It is probable, as the celebrated author^b of *Alciphron* remarks, that these circumstances are arbitrary, not necessary; for that the Supreme Being might, for example, have ordained that *scarlet* should have been otherwise painted on the retina; and consequently, that it should make a different impression on the brain, and excite a different idea in the mind.

Though we perceive only the *signs* of things, and not the things themselves, we cannot be led into error, provided similar perceptions are excited in the minds of all men by the same causes: which would not be the

^b Dr. Berkley, bishop of Cloyne. case,

case, if the mind conceived, by means of the sight, that a portrait is a convex, solid body; whereas the touch determines it to be a plane.

The mind does not perceive all impressions, but only those which are either strong, or are least familiar to us, and consequently most striking. Thus, though respiration or breathing, is an act of the will, yet we do not, in general, attend to it; because the mind is habituated to it, though we have the power of perceiving it when we please. Hence it is, that the attention of the mind being less engaged by slight impressions, it is left more at liberty to perceive those which are more important.

§. 27. *Attention* is that effort of the mind by which it applies itself intensely to the contemplation of an impression, so long as the representation of it continues, excluding all others. The attention is more strongly engaged by objects of sight, than those of the other senses; and therefore they make the strongest impressions on the imagination.

§. 28. *Memory* is that faculty of the mind by which we retain the ideas of impression after the object is removed.

Those

Those things are always retained longest and most forcibly, which most strongly engage the attention. It is more than probable that the brain, and not the mind is the seat of memory; and that strong impressions are, as it were, deeply and indelibly engraved on the substance of the brain; whilst those that are slight, leave no impression at all.

The memory is strongest between the 8th and 50th years of life; after that period the brain becoming more firm in its texture, it does not retain recent impressions so strongly as those which have been long stored up in the mind. It is perhaps for this reason, that aged persons are fond of recapitulating circumstances which occurred in the earlier periods of life.

The instances of the strength of memory are almost incredible. A very near relation of mine could, when a boy, repeat verbatim, one of Archbishop *Tillotson's* sermons after one reading. The celebrated *Scaliger* committed to memory the works of *Homer* in twenty-one days; and the other Greek poets in four months. *Muller of Leipsick* acquired, and perfectly retained twenty different languages; and the famous *Magliabecchi* retained
most

most exactly, the contents of any manuscript after one perusal.

There are many wonderful circumstances respecting the retentive faculty, which are inexplicable.

The mind has a power of recalling the traces of former impressions, provided they are entire and sufficiently strong; and, in this case, the mind is conscious that it has recalled them from the memory; but if they are weak, they recur without any remembrance of their source.

Sometimes ideas obtrude themselves spontaneously, repeatedly, and painfully, upon the mind; nor can it dismiss them at will. This is one great source of human misery; and as reason has very little power to counteract those painful impressions, the attention ought to be diverted by other strong and more agreeable impressions: Hence the benefit of change of place, amusements, and sometimes interesting occupations of the mind, to those who are depressed by grief, or labour under such corporeal maladies as excite painful sensations in the mind; and much relief has been obtained by opposing a passion of a contrary nature to that which predominates.

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An early habit of arrangement improves the memory. The late celebrated Baron *Haller*, who was a prodigy of learning, tells us, that it was his practice from early youth to commit what he read to paper, by classes, orders, &c.

Some of the human race have been found destitute of memory. Thus Madame *Le Blanc*, the wild girl found in France, and a Polish boy caught in the woods, after they were taught to speak, could give no account of their former life; because, having been destitute of the use of speech, the mind could not be impressed with any notions that could assist the memory; the artificial or arbitrary signs being too few for the purpose.

The memory is improved or weakened by our mode of life: It is improved by a regimen of vegetables and water, as I have myself experienced; and it is weakened by a stimulating diet. A person had an amazing memory until he was thirty; he then began to drink wine, and his memory failed him exceedingly.

Diseases, those of the head especially, often impair or totally destroy the memory. A person, after a violent fever, could not re-
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collect the letters of the alphabet, or even his own name. Sometimes the strongest and most agreeable ideas are retained, whilst the rest are lost: A musician, after a fit of illness, retained his musical ideas, but forgot every thing else. We are told by *Thucydides*, that during the prevalence of the plague in Attica, several of those who recovered were found to have lost their memory. Violent head-aches, apoplexy, exposure to violent heats, and a variety of other causes, have injured the memory; which, on the causes being removed, has been restored. Even in health some persons have alternately lost and recovered their memory, at certain intervals, without any assignable cause. Sometimes from disease; thus a person, who by a blow on the head was entirely deprived of his memory; when his health was restored, recovered the recollection of circumstances which had occurred many years before; but none of recent transactions.

On dissecting a man who had lost his memory, the brain was found to be dry, hard, and even friable; and that part of it from whence the nerves proceeded, was dry and shrunk.

Some

Some very old persons are not only destitute of memory, but of desire or appetite, even for food. The great *Duke of Marlborough*, and the celebrated *Dean Swift*, are said to have been mere *strulbugs* some time before they died:—Such is the lot of exalted talents, and superior genius?

Ideas seem to thrust out each other when the memory is, as it were, overloaded; as happens to men who read on a variety of subjects in quick succession.

§. 27. *Succession of Ideas.* It has already been remarked, that many impressions are so flight as scarcely to leave any traces on the memory: it is by the succession of ideas that we estimate time and duration; hence it is that time seems to move rapidly or slowly according to the nature of our present ideas.

The immortal *Shakespeare*, who, though no speculative metaphysician, had nevertheless a most intimate, and as it were, intuitive knowledge of the human mind, has admirably represented those circumstances which influence the succession of our ideas:^a and it very much imports *man, whose days*

^a As You Like it.

are few and full of evil; that, as he has, in some degree, the power of selecting his ideas, he should not be so totally engrossed by those ideas of sensation, which, though commonly deemed pleasurable, are generally unprofitable, as not to call up and arrest those reflex ideas which may afford rational and permanent employment to the mind.

§. 30. *Notions* are those ideas which are formed by *abstraction*, which is that effort of the mind by which we separate a part from the whole; as the quality of blackness, when I think of a negroe, independent of the circumstances of form, character, &c. in which he is not different from other men. Mankind, in the various stages of social improvement, have invented manifold signs or means of expressing their abstract ideas, as words, writing, hieroglyphics, printing, &c. The human mind, in its present state of existence, is so connected with, and clogged by, the body, that we are scarcely if at all able to abstract the idea of quality from that of matter. Thus, if I attempt to form the abstract notion of whiteness, strength, &c. I cannot separate them from one or other of those things

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with

with which I have found them connected, as a white wall, a black dog, a strong horse, &c. Nor can we even abstract moral qualities entirely and precisely from matter; hence it is that the all-wise, good, powerful, and *immaterial* Author of the universe has been represented by superstition under a corporeal form; and from this defect of the mind image-worship took its rise.

§. 31. *Association* is that faculty by which ideas are connected which have no intimate relation: thus when I think of a person, his place of abode, family, friends, &c. are apt to recur to my memory.

§. 32. *Imagination* is so far different from memory, that the latter only recalls the signs, whereas imagination recalls the sensations themselves; and the impressions on the mind are consequently much more vivid and strong.

These faculties of the mind therefore are distinct. Some men have strong memories, but weak imaginations; in others the imagination is strong, but the memory weak; and

and they are not often united in the same person. Memory may make a man learned, but imagination makes the poet. Imagination may represent sensations so strongly, as that they cannot be distinguished from the first and immediate impressions; thus, after hearing the sound of a bell for some time, the sound seems still to remain upon the ear after it has ceased.

If the traces of a sensation are very strong, they are often equal to a new and present sensation: hence *visions* often suggested by superstitious fears, or enthusiastic presumption; hence the strong impressions made by dreams, delirium in fever, and the false ideas of melancholy and mad persons, and which no reasoning can persuade them that they are not real.

§. 33. *Reminiscence* is by some philosophers distinguished from memory.

It is truly wonderful that the mind has a power of selecting and arranging ideas according to their similarity; and in this respect may be compared to a library, in which books on the same subject are placed together. I have already taken notice of the power of association, of which reminiscence is a part.

By a kind of classification, new sensations, and their signs, are, without any effort of the mind, placed next to those of a similar kind. The mind is led as by a clue from one thing to that with which it is connected. If I have forgotten the name of a certain tree, the general term *tree*, which is the class, presents itself; I afterwards run over in my mind the names of the fir, birch, walnut, &c. but all these I reject, until I recollect the *oak*, the name of which I had forgot, but now recognize by its affinity with certain qualities of that tree residing in the memory, though one of the abstract arbitrary signs, the name, did not then occur to me.

This faculty of the mind, and the advantages we daily experience from order and method, pointed out to philosophers what is called scientific arrangement. Thus the mathematician rises gradually from the most simple to the most abstruse and complicated propositions, each being intimately connected with that which precedes and that which follows; the naturalist divides his multifarious subjects into certain classes, orders, genera, and species. In this manner the celebrated *Linnæus* has made his arrangement.

Physicians

Physicians also, after the example of naturalists, have lately adopted a similar plan, of which an illustration is given in another Essay,^a it will be sufficient to remark for the present, that, by thus methodizing our ideas, we avoid confusion and perplexity, and exceedingly assist the memory; for as most of our ideas are complex, it contributes very much to the advancement of knowledge, that the mind should be able to recall the whole system of congenial ideas and notions by one arbitrary sign. Thus, when we mention a circle, the definition, diameter, radius, &c. recur to the mind.

Ideas recur in the same order in which they first entered the mind; thus if we talk of a just and pious prince, *Antoninus* and *Marcus Aurelius* occur to the memory.

§. 34. *Thought* is that faculty of the mind by which we attend to a series of ideas in the same succession in which they occur.

Des Cartes defined thought to be the essence of mind, intimating that the mind always thinks: this has been disputed by the materialists, who, were they to admit the

^a On the difficulties of studying Medicine, &c.

position, must allow the immateriality of the soul. Both parties have appealed to phenomena both in the sound and diseased state of the body; and, as always happens in these contests, each accommodate their conclusions to their premises. But we ought not to deny that the soul thinks during sleep, or whilst a person is delirious, or in a swoon, merely because the mind retains no consciousness of the impression; for we know that persons who walk in their sleep do many things which imply consciousness in the instant, yet have no recollection of what they did in that state.

Attention is the source of thought and the mother of science; and memory is its repository. Without attention, we could never connect two successive ideas, as the second would always obliterate the first; and it would therefore be totally impossible to attain knowledge.

Men complain of the shortness of life; and yet by not making a choice of proper objects of thought, or neglecting to fix the attention sufficiently, many of our hours and days pass away like a shadow, and leave no more traces behind than if they had not existed.

Those persons who have the direction of young people, ought therefore to give them an early habit of attention, and logical accuracy, in discussing not only subjects of literature and science, but every other; by this means they will not only afford them manifold advantages in their common intercourse with the world, but give them a relish for such subjects of enquiry as may at all times enable them to fill up their time in the most useful and agreeable manner.

What is the great source of idleness and dissipation?

It is owing to our not being accustomed to think; so that every effort to that purpose being painful, we decline the task, and turn aside to those objects of sensation, which, being at least frivolous, enfeeble the mind, and pervert the judgment.

It is probable that all men are not born with the same degree of intellectual power; yet the difference is not so great as is commonly imagined.

§. 35. *Judgment* is that act of the mind by which we compare our ideas, to determine how far they are similar or different. With
respect

respect to those ideas which arise from sensation, they are generally so simple, that it requires very little effort of the mind to form the comparison; as between colours, sounds, and other objects of the external senses.

But the objects of reflex sensations are generally more complex, and require a more intense application of the mind in analysing and comparing their different parts. This is particularly the case with abstract ideas or notions; and hence the labour and difficulty of attaining a tolerable knowledge of the different branches of the mathematics, and other sciences connected with them.

Even in subjects of a less abstruse nature, we are very apt to err; as when we admit two ideas to be similar, which are really different; and this often proceeds from want of due attention and patience in our examination. When we cannot attain to *certainty*, we are obliged to be content with *probability*; and, according as a proposition approaches more or less to truth, the mind affords a greater or less degree of assent. This often depends on the degree of our experience. A native of a hot climate will be so far from conceiving it true or even probable,

probable, that water can become solid, that he has no idea of the possibility of it.

Our judgments, even concerning moral opinions and conduct, are often very different. Some nations have deemed it warrantable to expose their infants, when they thought it inconvenient to rear them; others leave their aged relations to starve, when they become unable to provide for themselves; and even philosophers have not always agreed concerning the relative force of certain moral duties.

§. 26. *Reasoning* is a series of judgments: all reasoning depends on analogy or comparison of one idea with another. *Logic* is the foundation of all reasoning; and our reasoning powers are very much strengthened by geometrical studies: we cannot proceed a single step in forming our judgments without *analogy*, for we must compare before we can decide.

The mathematician employs analogy in the solution of his problems: analogy is the basis of natural and experimental philosophy: the moral philosopher uses it as a test of moral rectitude or depravity; it is the guide of the politician, and the rule of our conduct in common life.

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In no instance, however, is analogy so indispensibly necessary as in the medical art; and I am convinced that if, instead of vague theories, and fanciful hypotheses, it had been employed by physicians with caution and precision, physic would, long before this period, have been exempted from the invidious imputation of being conjectural and precarious.

§. 37. *Genius*, or ingenuity, is so far different from judgment, that as the latter is employed in analysing, comparing, and distinguishing ideas, genius consists in uniting them; and the more remote they are in their nature, and the more distant the resemblance, the greater the degree of ingenuity exerted in the combination.

When the great *Newton*, from the simple circumstance of the fall of an apple from a tree, deduced the doctrine of gravitation as a chief law of our system, the conclusion was very ingenious, because it united ideas very remote and abstruse in their similitude.

As judgment is slow, so genius is rapid, and often almost instantaneous in its conclusions, and is therefore more frequently connected

connected with a vivid and ardent imagination; and hence it is that the most ingenious men have been very deficient in judgment; and men of wit are rarely remarkable for that is called cold prudence.

Genius is of different kinds, but in what manner soever it may be exerted, it may be distinguished by the term *invention*. The poet, who draws witty allusions from new combinations of ideas, is as much an inventor, as the mechanic who contrives a machine, in which he combines certain powers which were never before united in the same manner.

Ingenuity, like all other faculties of the mind, is in some respects connected with, or influenced by, certain conditions of the body.

1st. With an irritable nervous system; and therefore persons of great corporeal sensibility have generally lively imaginations.

2^{dly}. With a delicate state of health; *Virgil, Paschal, Pope, and Baratter*, were invalids.

3^{dly}. It is supposed that climate has some share, and that the middle climates, viz. between the latitudes of 30 and 45, are most favourable to the production of genius; and that as the *Athenians* were formerly, so they are, even at this period, remarkable for ingenuity;

genuity; but were not the *Bæotians*, inhabitants of the same climate, proverbially stupid, infomuch that the celebrity of *Epaminondas* and *Plutarch*, their countrymen, could not wipe off the opprobrium?

4^{thly}. Wine, and other fermented drinks, are said to sharpen the wit; and many persons, when moderately elevated by them, evince a degree of sprightliness and ingenuity, which they do not manifest without it; and there is reason to believe that *Horace* wrote some of his best odes under the cheering influence of Falernian wine.

5^{thly}. Even some morbid affections of the body seem to whet the ingenuity. Baron *Haller*, who was a poet, tells us that he wrote verses more readily when labouring under a fever; Pope *Paul II.* found his powers of eloquence increased by fever; and we are told that a blow on the head rendered a man remarkably ingenious, who before the accident was not so. Maniacal, melancholic, hypochondriacal, and hysterical patients have often more vivacity of imagination than in health, owing to a greater degree of irritability of the nervous system: but in all these instances, the effects cease with the cause.

Old

(Old age weakens the invention as it does the memory.

§. 38. *Truth* is a due conformity of our ideas with their objects; *Error* is the reverse; that is, when our ideas, notions, or opinions are different from those things from which they are derived.

Our external senses sometimes deceive or lead us into error; but these errors are rarely of any great importance, and one sense may correct another.

But our greatest and most essential errors are those which arise from the judgment we form of the objects of reflection.

With respect to simple ideas, we can rarely err; because the circumstances which are the objects of comparison are so few, that it is scarcely possible for us to draw a false conclusion: no person of a sound mind would conclude that two and two are equal to five.

But it is in the contemplation of complex ideas that we are liable to error, because we do not perceive all the parts of complex notions, and nevertheless argue from a *few* that we know, to the *whole*, many of which may be totally unknown.

From

From this imperfect analogy, proceed manifold errors in philosophy, natural and moral, religion, politics, &c. Hence the fallacy of hypothesis; when having discovered *some* circumstances which are conformable to truth, we take it for granted, without examination, that *all* the others are so likewise.

Our errors are often voluntary, and may proceed

1st. From indolence, and an aversion to examine things with accuracy, owing to our not having been in the habit of thinking closely; and hence the epithet of *thoughtless* has been justly applied to those, who, from not being accustomed to enquire and examine with care, form their conclusions from a superficial view of things and opinions, and thereby constantly deceive themselves. Hence the manifold and often very important errors people of all ranks and degrees fall into, with respect to conducting the ordinary concerns of life; for practical errors must generally be the consequence of imperfect knowledge and false inferences.

2^{dly}. Our errors may proceed from vanity and pride; for having once adopted a false opinion,

opinion, we are often so deficient in candour and good sense, as to deem it detracting and disgraceful to confess our errors. From this source we may trace many of the sects in religion & philosophy, and the parties in politics.

3dly. Our errors are often the result of some predominant passion, which either prevents us from examining into the truth of things with impartiality; or, knowing the truth, hurries us on to act contrary to the clearest conviction.

4thly. We are often led into error by prepossession or prejudice. We are very apt to adopt the opinions of our relations and friends implicitly, and without examination, from the good opinion we in general entertain of their judgment and candour; and it is often sufficient reason for us to reject an opinion, because it is advanced by a person whom we dislike.

In opinions relating to science we are very apt to support, most strenuously, those doctrines which have been inculcated by our preceptors and professors; and hence it is that errors have been perpetuated, and the progress of true knowledge exceedingly retarded.

5thly. The

5thly. The bulk of mankind are too lazy to think; especially concerning opinions which from their complicated nature require a considerable exertion of the mental powers; and which, from want of habit and method, becomes painful and disgusting; therefore they generally rely on the dictatorial authority of a few, who *being but men*, are therefore fallible, or, by various unworthy motives, are induced to misrepresent and mislead.

I have entered more fully into this subject, on account of its great importance, and shall conclude with a professional remark.

In no art or science have errors been so frequently committed as in the theoretical and practical parts of medicine.

The speculative opinions have often indeed been inoffensive, though erroneous; because those who entertained them did not always permit them to influence their practice.

But the most fatal consequences have arisen from an imperfect analogy, by which a supposed fact, not altogether inconsistent with truth, has been adopted as a guide to some very important circumstance of practice, to which, from the very remote similarity between them, it is applicable only in a very limited degree.

Thus, from an imperfect knowledge of the different, and sometimes opposite, natures of those species of disease which is vulgarly distinguished by the common name of *colic*, many most egregious errors are daily committed.

An ignorant nurse has found relief perhaps, in her own person, from a dram of gin, probably warmed by pepper, or a full dose of Turlington's drops; and she prescribes it on all occasions of colical uneasiness, because she does not know that there is any other species of colic but the flatulent; in which her *infallible* remedy may not do much mischief: but as there are several other species of colic of an opposite nature, the means she prescribes must in them be very injurious, and even fatal.

This remark is applicable to almost every disease, in the management of which egregious blunders must be committed, as often as we are guided by a slight conformity, instead of an accurate discrimination of all the circumstances.

Ignorant practitioners, nurses, and quacks, are very frequently led into such errors; many of them because they have never been in the habit of thinking at all; and even such of them as enjoy a moderate portion of

common sense, are yet utterly disqualified to form just conclusions; because they have neither ability nor patience to collect, compare, or judge of, the necessary premises.

With respect to those whose understandings have been even highly cultivated by a general or even a scientific education, and who come under the denomination of Gentlemen or Lady-Doctors; howsoever the analogical and discriminating powers of their minds may have been exercised in particular branches of knowledge; yet when they employ them on medical subjects, they are perpetually liable to error in the application; for the same reason that a very learned lawyer, or a skilful physician, may not be a good polemical divine, a profound mathematician, or a skilful minister of state; because it is necessary that the human mind should be long and assiduously engaged in a train of scientific thinking, before it can judge accurately concerning the ideas suggested by its objects.

Should it be alledged that, with respect to medicine, some medical men have *generously* supplied the public with plain treatises on diseases and their cures; I answer, that such productions

productions would no more qualify a person to practice physic with safety and success, than his reading the article on watch-making in the *Encyclopedie* would enable him to rival *Mudge* or *Arnold*, or even a very inferior workman in that branch; and it ought ever to be held in mind, that, in so much as we fall short of the highest possible perfection in any art, we can be but ignorant bunglers in various degrees.

It may be proper to take some notice of the morbid changes made on the judgment, in consequence of certain bodily diseases.

§. 39. *Delirium* is a general term, which implies an error of the judgment produced by some morbid change in the brain, which is probably the seat of the soul; and therefore it is reasonable to suppose that its faculties must be impaired by every change of this kind.

Delirium, in a more limited sense, implies a disorder of the understanding connected with fever; and when there is no apparent fever, the terms hypochondriacism, melancholy, and madness, are used, according to the nature and degree of the affection.

All these affections are supposed to proceed from increased rapidity of the circulation in the vessels of the brain; to which it is supposed to be determined from other parts of the body with too much force, and in too great a quantity. This opinion is partly grounded on the qualities of certain causes which we know produce disorders of the mental faculties; as rage, wine, and other fermented drinks, opium, &c. all of which are stimulants; and partly from dissections of those who have laboured under various kinds and degrees of delirium. In those cases the blood-vessels of the brain have been found very much distended with blood, and sometimes even burst; inflammation of the membranes, matter formed in the substance of the brain; a very considerable quantity of watery fluid in the ventricles, &c. especially in those who have died of fever. In those who have died of melancholy, madness, &c. besides some of the appearances just mentioned, the substance of the brain has been found of a very hard and firm texture, sometimes of an unusually small size, and sometimes swellings in particular parts of it, of a schirrous, stony, or bony nature, &c.

When we consider the intimate connexion between mind and body; especially the brain, which is the source of sensation and perception, and the seat of the thinking faculty, it will not be difficult to conceive, how morbid changes made in the brain do, and must necessarily derange the imagination, and impair, or totally unhinge, the faculty of judgment; insomuch as that it shall not be able to distinguish between truth and error, reality and fiction.

When we consider the deplorable perversion of the most exalted genius, the most refined understandings, and the most amiable dispositions, by corporeal causes, it should not only impress us strongly with the deepest humility; but warn us against those excesses, especially of the passions, by which the reasoning faculty, the noblest privilege of man, may be totally and irremediably unhinged: a state worse than death itself.

The perversions of reason and the imagination are very surprising. Besides those which occur in fevers, I shall mention a few instances, out of many which occur in madness and melancholy.

Some of those patients, whilst in every other respect the judgment seems to be sound, err only with regard to one object or idea, excited generally by some inordinate passion, as anger, love, ambition, &c. and the corresponding ideas are almost perpetually present.

Some imagine themselves kings, princes, &c. To others the objects of their affection, their hatred, or their revenge, almost constantly present themselves.

The superstitious madman is tortured by the constant dread of eternal punishment; whilst the presumptuous enthusiast is elated by the idea of his intimacy with God; and some of them have believed themselves to be God himself.

The ruling passion, which chiefly occupied the attention in health, generally preserves its dominion in the distracted mind.

None are so much objects of compassion, but who seldom meet with it, as those who, from an irritable system of nerves, and a delicate state of health, labour under the various degrees of hypochondriacism, up to incurable melancholy.

With these unhappy people, the prevalent idea is a constant and painful solicitude
about

about health, excited chiefly by a fear of death, rather than by an anxiety about the comfortable enjoyment of life.

The whimsical ideas and apprehensions of such persons, though generally subjects of ridicule to others, are, to the sufferers, real and grievous evils.

One man asserted that he was made of glass, and therefore would not quit his house, lest he should be broken: another that his legs were straws, and could not support his body: a quondam patient of mine being, in his way to a ball-room, obliged to pass through a narrow lane, conceived himself to be so enormously swelled that he could not pass it, returned, went to bed, and sent for his physician. Some have conceived themselves to be transformed into beasts, birds, and even insects; others, that they were dying, dead, or absolutely buried.

In all these cases the patients are seldom convinced by argument; though some are not always proof against the shafts of ridicule, the arts of deception, or a powerful and *feeling* appeal to the senses.

A person who insisted that he had no legs, and therefore could not move, was convinced
by

by some smart strokes on the shins; another who believed that he had no vital warmth, was cured by wetting some of the cloaths he wore with spirit of wine, and setting them on fire. Whatsoever excites a powerful impression of a nature contrary to the predominant insane idea, will often produce a salutary effect.

§. 40. *Idiotism*, in its various degrees, seems to be opposite in its nature to delirium; the latter being the consequence of the impressions on the mind being too strong and vivid, the former being produced by their being too weak. The causes of idiotism and loss of memory appear, on dissection, to be nearly the same.

In a particular district of Switzerland, a very considerable proportion of the inhabitants are born idiots: persons of great talents, or who spend much of their time in intense study, often become drivellers in advanced life; and persons labouring under diseases sometimes fall into this state.

Sometimes persons are recovered from this state by some powerful stimulus producing a great and sudden change in the system; as
by

by wine, sudden joy, &c. and in one instance it was effected by inoculating the itch.

I shall conclude this subject, by remarking, that as the degrees of madness and folly are very numerous; and as, from the imperfection of human nature, the wisest men are not exempted from a mixture of both in their composition; so, the speculative observer of human life and manners will readily accord with *Damasippus*,^b that all men are mad in some degree, but that in some the fits are less violent, and the intervals more lucid, than in others.

§. 41. *Pleasure and Pain.* I have already remarked, chap. I. §. 9, that bodily pleasure and pain are both modifications of sensation.

It would be difficult to determine, in every instance, what change is produced in the nerves, by which a pleasurable or a painful sensation is excited; or why some colours, sounds, and tastes, are grateful or disagreeable to our senses; why, for instance, the smell of the rose is preferred to that of the nettle.

There seems to be, in many instances, but a very thin partition between pleasure and pain;

^b Horat. Sat.

pain; tickling to a certain degree is pleasurable; but in excess, painful. Whether we have any pleasure in the sense of our existence, is perhaps doubtful; we are however certainly gratified in the indulgence of the appetites of eating and drinking, by which it is preserved; though not always in the objects of the other senses, in which the perceptions are often indifferent: thus I view a triangle without either pleasure or pain.

I have already remarked §. 20, that even painful sensations are productive of salutary effects, and the Supreme Being has interwoven a relish for pleasurable sensations with our frame, to excite us to the performance of those duties which are necessary to our preservation.

§. 42. *Appetites* are the propensities alluded to §. 41. These we have in common with other animals, who are instinctively excited to eat and drink for their preservation.

The instances of depraved appetite are many, and some of them surprising. The longings of pregnant women are well known. Those of persons labouring under certain diseases afford a strong proof of that instinctive

instinctive sagacity, which, in health, is almost totally extinguished by the force of education and custom.

The skilful physician will easily distinguish this salutary craving, excited by uneasy morbid sensations, from depraved habits of indulgence; and whilst he will gratify the former to a degree which rigid rules of regimen might not warrant, he will endeavour to regulate, and even restrain, the latter, as injurious to the welfare of the patient.

§. 43. The appetites are connected with the *Will*, which is that action of the mind by which it prefers certain conditions to others; inclining us to enjoy what is good, and to avoid what is evil, or inimical to our corporeal safety. The will of brutes is instinctive, and in a great degree irresistible; and indeed this is in some degree the case with man, with respect to some of his appetites when very urgent; which ought however to be under the regulation of reason. Thus, a man, in gratifying his hunger or thirst, ought to stop short of that excess in the indulgence of either as may be injurious to him. But what shall we say to the wanton
abuse

abuse of nature, by creating and indulging artificial inclinations, to the utter perversion of our natural appetites? Do we not daily anticipate our natural cravings, by eating without hunger, and drinking without thirst?

The will also excites us to seek those conditions or situations which may conduce to our ease; and to avoid whatever may be hurtful to us; but as what may be apparently beneficial, may be really injurious, we are endued with the faculty of comparing and judging concerning causes and effects. But here also the will is misled by erroneous conclusions, or the arbitrary influence of the passions; and we often choose present gratification, though conscious that it will be followed by future inconvenience, distress, or danger.

I formerly observed §. 13, that some of the functions of the body are under the direction of the will; and whilst the organs are in a healthy state, whatever we will, they perform. Thus, if I will to move my arm, a variety of muscles conspire to move it instantaneously, in this or that direction, and with a degree of force and celerity adapted to the occasion. But the will cannot always be obeyed;

obeyed; it may be counteracted by a sense of inconvenience, as when a gouty man, though he wishes to change his posture, may be restrained by the fear of pain; or the muscles may be totally unable to act, as in the case of a paralytic limb.

Though it is admitted in general by physiologists, that many of our functions are performed without the interposition of the will, and merely by re-action in consequence of stimulus, as when the heart acts when excited by the heat, bulk, &c. of the blood; yet some alledge that the will or mind, without our being conscious of it, superintends, and with the utmost wisdom and sagacity, directs all the operations of the œconomy, whether in health or disease; in the former case silently, in the latter often perceptibly, and even powerfully. This superintending power has been called *Nature*, a term which has been often a refuge of ignorance.

But is Dame Nature so sapient as always to direct for the best purpose? When fear is excited by a sense of danger, what more absurd effect could be produced, than tremor and debility, which disqualify us from exerting ourselves either to resist or to flee from danger?

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It is alledged, that when the body is attacked by a morbid cause, nature excites motions best fitted to remove it. But the very reverse is the case; for when a concretion blocks up the gall-duct or kidney, instead of widening the passages to promote its removal, she excites pain to straiten it, and prevent its passage. What benefit do we derive from epileptic and other convulsions? No benefit, but much injury. She promotes, say they, the beneficial crisis of fevers; this is not true, otherwise why are so many destroyed by fevers, without the assistance of the doctors?

§. 44. The *Passions*, or affections of the mind, being as it were emanations of the soul, and of a nobler nature than the appetites; though they are poetically called *the gales of life*, are more frequently the *hurricanes* and whirlwinds of it; and manifold are the evils, both physical and moral, which result from their excess or perversion.

The influence of the passions on the organs of the body are very great, even in health. They may be divided into the stimulating or exciting, and the sedative or depressing

depressing passions. Among the former we may reckon joy, hope, anger, love, study, which is a species of this affection, and shame. The depressing are, pity, grief, fear, terror, anxiety, despondency, aversion, and hatred. These effects are, however, often of a mixed kind according to the degree.

The passions are manifested by various changes of the countenance and voice, but especially of the *eye*, which may be truly deemed the index of the mind; hence the foundation of physiognomy, a study very necessary to medical men.

§. 45. The passions not only produce many diseases, but they exceedingly exasperate them. There are many instances on medical record of the surprising and dreadful effects of violent passions; and many have been instantaneously destroyed by them.

As they chiefly and more immediately affect the brain and nervous system, and, through them, every other organ and function of the body; so on inspecting the bodies of those who have died from violent passions, there were the same appearances of disease in the brain, as are enumerated under delirium, madness, and melancholy.

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With respect to those diseases which are usually deemed imaginary, many of them may be so at their commencement; but such is the influence of the mind over the body, that the latter is eventually affected, and an imaginary is converted into a real disease.

This ought to be a powerful incentive to hypochondriacal persons, to resist, or divert, those workings of the imagination, which embitter life, and must infallibly produce those very evils, which as yet exist only in imagination.

Such unhappy persons are frequently the dupes of knaves, who often convert ideal into real diseases; whereas a physician of skill and candour will readily distinguish the cause, and if he discovers it to be real, he will use his utmost endeavours to procure speedy and effectual relief; if imaginary, his knowledge of the human heart, and of the influence of the mind on the body, will enable him to alleviate those perturbations of mind, which are the sources of much anxiety and distress.

B O O K . III.

Of the VITAL ORGANS and FUNCTIONS.

C H A P. I.

Structure of the Heart—Of the Arteries and Veins—Circulation of the Blood—Various Causes of the Circulation explained—The importance of the Circulation to the Vital, Animal, and Natural Functions—Result of Experiments made by Transfusion of Blood into the Veins—Of transfusing Remedies by the Veins—Determination its nature.

§. 46. **T**HE *Vital Functions* are so called, because it has been supposed that they are more peculiarly necessary to life than the animal or natural functions; but this, as I have already remarked, is not strictly true.

The *Vital Organs* are chiefly the *Heart* and *Lungs*, situated in the middle cavity of the body, and defended by a bony case; behind by the spine or back bone, on the sides and before by the ribs and sternum or breast bone.

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§. 47. *The Heart, and Circulation of the Blood.* The *Heart*, which is the centre of motion in our system, is a hollow muscle situated on the left side of the breast, and inclosed in a membranous bag. It consists of four distinct cavities or chambers, or rather of two pairs, called the right and left *auricles* and *ventricles*, which are divided by a partition. To these chambers are joined several large tubes or blood vessels, and, at the several openings of communication, are placed valves, or flood-gates, which open and shut occasionally. The heart is amply supplied with nerves.

When the *blood*, being the *natural stimulus* of the heart, passes from the great vein into the right auricle, the auricle contracts and pushes it forward into the right ventricle, which, contracting in its turn, propels the blood into a large artery, and this conveys it to the lungs; which, being contiguous to the heart, quickly send it back again by a vein, which empties itself into the left auricle, and the auricle being filled, contracts and thrusts the volume of blood into the left ventricle, which discharges it into the great artery; by the branches of which it is distributed to
every

every part of the body (except the lungs) and returns again into the great vein, which communicates with the right auricle: the use of the flood-gates is to prevent the blood from returning back into the cavities from which it had been just discharged.

Thus the *Circulation* of the blood is performed; which was discovered in the last century by the celebrated Dr. *Harvey*, Physician to King CHARLES the first. Before that period, very erroneous opinions were entertained concerning the manner in which this important function was performed.

§. 48. The uses of the circulation are manifold and important.

1st. By it the powers of life and motion are almost solely sustained; for when it ceases, death soon ensues: but it may be apparently stopped, as in swoons, and even the motion of the heart and arteries suspended for hours, and yet the patient recover:—a caution against early burials.

2^{dly}. It is the chief support of respiration; for in faintings breathing is almost entirely suspended; and fevers and other diseases of the heart affect the lungs very much.

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3^{dly}. The

3dly. The functions of the brain and nervous system have a peculiar dependance on the circulation; and hence it is that sensation, motion, and the faculties of the mind, are peculiarly deranged by fevers, and other irregularities of the circulation.

4thly. As the blood supplies all the other humours of the body, so a sound state of the circulation is a chief cause of health in digestion, and all the secretions and excretions.

5thly. Nutrition depends peculiarly on a regular circulation, therefore the body cannot be properly nourished in diseases depending on morbid circulation.

§. 49. The *Arteries* which convey the blood from the heart, being endued with a muscular contractile power, are considerable assistants to the heart in pressing forward to every part of the body the blood, which they distribute by an infinite number of branches, and which, becoming at length exceedingly small, unite with other pipes called *Veins*, which gradually increasing in size, unite at length in the large vein which opens into the right auricle.

Hence

Hence it appears that there is, as it were, a double circulation; one between the heart and lungs, and another between the heart and the rest of the body. But as the unborn infant does not breathe, so a very small quantity of blood goes to the lungs before birth, the rest being diverted by a tube which is shut up after birth.

The arteries are of different kinds, and their cavities are cylindrical and not conical; they have different layers of coats, one of which, being muscular, enables them to contract, and push on the blood. The coats of the smaller arteries are thicker in proportion than those of the larger, and hence they are less liable to be burst. They generally branch off at acute angles, and join or anastomose several times in their course.

They terminate in various ways.

1st. The arteries convey red blood into red veins.

2^{dly}. They branch off arteries of a smaller size, which receive a yellowish fluid called *serum*, which is thinner than blood.

3^{dly}. Many of them open in veins called *lymphatics*, to be described in Book IVth.

4thly. Many of the serous arteries empty their humours into the cellular membrane in almost every point of the cavities, interstices of vessels, nerves, and muscular fibres, which they nourish and moisten.

5thly. The fine arteries discharge the matter of perspiration on the skin, and in the cells of the lungs.

§. 50. Veins have stronger coats than arteries, but have no muscular coat, and therefore do not contract; they have valves or flood-gates, which prevent the blood from flowing back again in its course to the heart; the veins therefore carry the blood in a contrary direction from that of the arteries. The veins are,

1st. The red veins, which receive blood from the red arteries.

2dly. The lymphatics, which suck up or absorb all the fluids from the cellular membrane and every cavity, and communicate with glands, &c. and uniting, carry all these humours back to the heart, through a duct lodged upon the spine.

The blood-vessels are every where accompanied by nerves, by which means every
organ

organ is supplied with blood and sensation; and these branches are so minutely distributed, that if we thrust the finest needle into the skin, pain is excited, and blood discharged; a proof that both nerves and blood-vessels are wounded.

§. 51. I have observed that the blood is the natural stimulus of the heart and arteries. The qualities by which it excites those organs, are its bulk or volume, its heat, and a certain degree of pungency.

§. 52. The *volume* of blood being an antagonist to the muscular power of the heart and arteries, stretches their sides, and irritates their nerves; and their muscular fibres are thereby urged to a convulsive contraction, by which the cavities are emptied; when another torrent of blood succeeding to the former, they are again filled, and again contract. The contraction of the heart and arteries is called their *systole*, and the interval between one contraction and another, during which the arteries are distended with blood, is called their *diastole*.

The throbbing of the heart, and the pulsation of the arteries, or what is commonly called the *pulse*, takes place during the diastole or dilatation of those cavities by the influx of blood; and they are not merely stretched, but actually moved out of their places, by the force of the torrent.

The *pulse* is different in degrees of strength and frequency, according to the different periods of life, and other circumstances; in a new-born infant it beats about 134 times in a minute, in middle age from 60 to 80, and in extreme old age from 50 to 24. It is generally quicker in women than in men; it is slower in the morning than at night; fasting than after a meal; when we are rest than when in motion; asleep than when awake; in cold than in hot weather; and the various passions of the mind produce considerable changes of the pulse. Hence the impropriety of invalids consulting their pulse instead of their feelings. I was lately consulted by a whimsical patient, who declared that from the quickness of his pulse, he had laboured under a fever for twenty years.

§. 53. Another exciting cause of the heart's motion is the *heat* of the blood, which is from 96 to 98 degrees of Farenheit's thermometer. Heat we know is a powerful stimulant.

Philosophers are not agreed about the nature and causes of heat in general. Sir *Isaac Newton*, and most of the British philosophers, have considered it as an effect of motion; the foreign philosophers alledge, and I believe justly, that heat and flame are not generated, but merely extricated, by motion; fire being a constituent principle of all bodies, and remaining there in a quiescent state, and only set in motion by accidental causes.

Physiologists have not been unanimous with respect to the cause of heat in animal bodies; but if we only suppose that a portion of it existed at our first formation, we may easily account how its activity is supported by the motions of our system, and may be occasionally increased by various causes.

Of these causes the chief is the motion of the circulating blood; hence strong exercise, and fever, which increase the force of the circulation, always increase the heat of the body; and some appearances afford reason

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to suspect, that an intestine motion of the fluids, or fermentation, may contribute as a cause; together with the electric fire, which is a component principle of the human system.

The human body will, under certain circumstances, bear a very extraordinary degree of heat. Messrs. *Du Hamel* and *Tillet* found that the female servant of a baker could bear the heat of an oven for some time, when at 325 degrees; which was 113 degrees above that of boiling water. Some gentlemen repeated the experiment in London, and remained a considerable time in a room wherein the thermometer stood at 211; a heat sufficient to roast eggs, and broil beef-steaks. But without having recourse to an hypothesis, more ingenious perhaps than true, that the body resisted the impressions of this extreme heat, by an innate power of generating cold; it may be accounted for on the simple principle, that the heat of bodies is always in proportion to their density, and that of the human body being much less than that of glass, mercury, or other metals, and air being much less dense than either, we can easily apprehend that the heat of the
body

body might not much exceed 100 degrees, and it is very probable that the heat of the air in the room was considerably less.

The heat of the body in high fevers is about 108 or 110.

When the temperature of the air approaches that of the body, it acts as a stimulus to the circulation, and increases the sensibility of the body; but eventually relaxes the solids, weakens the force of the circulation, and enfeebles the whole body. Hence it is that in hot climates, where the heat is equal to, or even greater than, that of the body, during the greatest part of the year, the natives are enfeebled and enervated both in body and mind.

§. 54. *Cold* has, by some philosophers, been supposed to be a positive quality; but it is really no more than a diminution of heat, as even the coldest bodies contain latent fire. Moderate cold braces and invigorates the body; but in the extreme, chills all its powers and faculties. In Siberia, the cold is so intense as to freeze brandy, and by its sedative power quickly suspends the powers of life, if not resisted by exercise; and the
late

late ingenious Dr. Solander was nearly destroyed in this way.

Artificial cold, produced by certain mixtures, congeals even quicksilver into a malleable mass.

§. 55. It is also supposed that the blood acts as a stimulus, by the pungency of some of its principles, particularly the ammonical salt.

The *Blood* consists of red particles swimming in a yellowish fluid called serum. The shape of the red particles has been generally supposed to be globular, but they have lately been discovered to be flat.

The blood in a sound state is of a florid red, owing, as some think, to the iron in our fluids; but it is more probably the result of original conformation, though it is often changed in its colour, even in health, without any assignable cause. In diseases it has been sometimes surprisingly changed; in one patient it appeared of a crystalline colour, in another white, in a third of a bluish aspect; and in some cases black. Besides the changes it undergoes in its colour, its consistence is also frequently changed in diseases;
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in some cases it is pale, thin, and watery; in other dense and buffy; and in some putrid diseases, its texture seems to be destroyed. But it must be confessed that these appearances cannot be much relied on as indications of the nature of disease; for it is often apparently found in violent diseases, and its aspect is sometimes different in different cups of blood taken at the same bleeding.

These observations are not made merely to gratify curiosity, but to obviate and counteract some ill-founded notions which many patients and some practitioners are apt to entertain concerning a supposed connexion between certain diseases and the appearance of the blood. It has been too frequent a practice to take away a little blood *to see how it looks*; and when thought to be bad, more perhaps has been taken for that reason; but when called in, I have sometimes had reason to wish that the experiment had been omitted, either as unnecessary, or improper.

As the blood flows from a vein, a fine vapour exhales from it, which is supposed to contain a portion of the volatile salt, which by its pungency stimulates the heart and blood-vessels. As this vapour is supposed to
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be elastic, and susceptible of different degrees of expansion or rarefaction, in proportion to the heat of the body, it is believed by some that it produces an intestine motion of the other principles of the blood, and preserves their fluidity.

The serum contains a mucus, or glutinous matter, which is supposed to be the chief matter of nourishment.

It has been supposed that one globule of blood is divided into six globules of serum, one globule of serum into six of lymph, and so on in decreasing series; but later microscopic observations do not seem to confirm this opinion.

The blood is thought to contain about one thirtieth part of air, partly perhaps phlogisticated, partly fixible, and some have asserted that there is common air in the blood.

Blood, very soon after it is exposed to the air, is formed into a solid red mass, from which the serous or watery part separates slowly. On the top of the red mass there is sometimes a coat of a buff colour, which has often been mistaken for a sign of disease, though it is frequently accidental. The proportion of the grosser and thinner parts of
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the blood is different in different persons; the red and mucous particles not only abound in strong laborious people, but they are more compact and firm; and the reverse in lax and delicate constitutions. As every person's blood therefore seems to be so peculiarly adapted to his own system, the attempts made in the last century to transfuse blood from one animal to another, could not be expected to succeed. The reader may be amused by some account of this curious experiment.

After various experiments made on brutes, by which an equal quantity of blood was drawn off by one vein, as was transfused by another, so that no injury might be sustained by over filling the vessels, the experiment was at length made on the human body. The expectations formed from this experiment were very high; especially as some old animals, particularly a dog and a horse, seemed in some degree to have renewed their vigour, by exchanging part of their blood for that of younger animals.

Some of the first experiments made on men did not seem to be followed by any bad effect, and indeed after the first trial made at Paris on a young idiotical person, into whom
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some ounces of the blood of a lamb were transfused, he seemed to have become more alert and sensible; but on a second experiment he was seized with a phrenzy, and died apopleptic. Notwithstanding this dreadful event, they had the audacity to repeat the experiment on another person in France, and on two in Italy; and all of them being evidently destroyed by it, the practice was prohibited.

The experiment was also made in this country, and the Royal Society had determined to repeat it, but were happily restrained by previous information of the fatal event at Paris.

Experiments have also been made by *Mr. Boyle*, *Sir Christopher Wren*, and others, by infusing wine, opium, &c. into the veins of animals; and not long ago a physician at Guadaloupe made several experiments on the human body; and from some trials, by which persons are said to have been cured of inveterate diseases by this means, the expedient seems to merit attention, especially as we are assured that alarming symptoms from the bite of a viper were removed by injecting spirit of hartshorn diluted into the blood.

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It is worthy of remark, that wine, opium, emetics, and purgatives, thus transmitted into the circulation, had the same effects as when taken into the stomach.

The quantity of blood supposed to be contained in a middle-sized man is about twenty-eight pounds.

§. 55. Another cause by which the heart and arteries are stimulated to contract, and promote the circulation, is the *resistance* made to their power on the surface of the body, and in the lungs, by the *weight* of the atmosphere; which obliges them to exert their powers to overcome this resistance, otherwise the circulation must cease.

This incumbent weight of the air is about 3000lb. which, the barometer shews, is perpetually varying; the weight being greatest when the mercury stands at the greatest height: hence invalids are affected by changes of weather, especially by the fall of the barometer, the solids being less braced and strengthened in proportion as the weight of the air is lessened.

The motion of the blood is not equally strong and rapid in every part of the body;

for it becomes more flow as the arteries become smaller, and form angles, which increase the friction, and consequently the resistance.

The force of the heart is very great, but philosophers have not agreed in the estimate; which some have equalled to the weight of 180,000 pounds, others deemed it much less. It is certainly considerable, though not reducible to calculation: it is supposed to be so great, as to move the column of blood 3000 feet in less than a minute, if there were no obstacles to its progressive motion.

But notwithstanding the various and great resistances to the propulsive power of the heart, from the sides of the arteries, the angles and flexures they make in their course, and the weight of the atmosphere, &c. the rapidity of the blood's motion is so great, that, according to computation, 9600 ounces or 600 pounds of blood pass through the right ventricle of the heart every hour, or about ten pounds in every minute; but no accurate calculation can be made of the time in which the whole mass of blood returns to the heart, because of the inequality of its motion in the different stages of the circulation; as its motion

tion through the small arteries and the veins is much slower than through the heart and large arteries.

To prevent a stoppage in the circulation through particular vessels, from some impediment to the passage of the blood, the arteries communicate with each other; and when it cannot pass by one branch, it returns back, and enters another, where there is no impediment.

The motion of the blood may be divided into *progressive* and *intestine*. The nature of these motions will be explained when we consider the affections of the circulating system.

During health there is an equal distribution of blood to every organ in proportion to its size; and the constitution, by its innate powers, endeavours to rectify any small changes in the balance of circulation.

But we shall see hereafter, that many violent and dangerous diseases proceed from excessive changes of this balance, owing to the current of the circulation being irregularly and permanently *determined* on particular organs.

BOOK III.—CHAP. II.

RESPIRATION.

Organs of Respiration described—Inspiration—Expiration—Uses of Respiration—Air—Qualities of it necessary for healthy Breathing—Dangerous Effects of Foul Air—An important Caution to the Masters and Mistresses of Public Schools—to Parents—Affection of the Breath on high Mountains—Causes which probably destroy the vivifying principle of the Air—Articulation, the Organs of it—Morbid Affections of the Vital Powers—various kinds exemplified—Morbid progressive and intestine Motion of the Blood—Morbid Determination—various kinds—Fever, its general nature—its varieties—Inflammation—Hæmorrhage—Morbid Affections of Articulation.

§. 56. **T**HE *Larynx*, or wind-pipe, is situated in the upper and fore part of the neck, and is formed of several hollow cartilages, which have a narrow opening into the throat, immediately behind the
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root of the tongue; this opening is covered by a moveable cartilage, which allows the air to pass to and from the *lungs*, but guards the passage against the entrance of our foods and drinks. As the wind-pipe descends toward the lungs, it is formed of thin cartilages not completely circular, connected by a thin membrane. Having descended some way into the breast, the wind-pipe becomes entirely membranous, and entering the spongy substance of the lungs, is divided into a great number of small tubes which terminate in cells, on the surface of which an infinity of small arteries and veins are dispersed, and many vessels of a still smaller order open into the cavities of those cells. The lungs are supplied with considerable nerves which accompany the blood-vessels.

The *Diaphragm*, or midriff, is a muscular membrane which divides the cavity of the breast from that of the belly. Between the ribs there is a double set of muscles, and the belly is also covered with various muscles—all the organs described assist in the office of respiration.

The column of atmospheric air descends through the larynx into the cavity or air-

cells of the lungs, the expansion or inflation of which is favoured by an enlargement of the cavity of the breast, owing to an elevation of the ribs, and a descent of the diaphragm. This is called *inspiration*. But the air being soon heated and rarefied in the lungs, stimulates the nerves of the air-cells, and we are instinctively obliged to discharge it by *expiration*; otherwise we should soon be suffocated, as happens to persons who are drowned or strangled. The expulsion of the air is promoted by the contraction of the muscles of the ribs, and of those of the belly, the latter pressing the midriff upwards; by all which the cavity of the breast is lessened, and the air pressed out of the lungs.

The rarefaction of the air remaining in the lungs after each expiration, favours the descent of the heavier column of atmospheric air; and this seems to be a chief cause of inspiration: The motion of the blood through the arteries of the lungs is very rapid during the expansion of the cells by inspiration; but much retarded during expiration; whilst the return of the blood through the veins is promoted. Respiration promotes the circulation through the vessels of the liver, stomach,

stomach, intestines, spleen, &c. by the alternate descent and elevation of the diaphragm.

The use of respiration is to cool the blood sent from the heart; and to carry off a fine vapour discharged from the small vessels, and which contains the impure and phlogisticated parts of the blood; and it is a curious fact, that whereas animals that breathe, are suffocated when the communication with the external air is suspended for a time, because the impure vapours cannot be carried off; so on the other hand, vegetables die, when they cannot discharge their pure air, and receive impure air, which constitutes a chief part of their nourishment. As the generation of noxious air, by a variety of causes, must be so great, that in the course of many centuries it must have been so accumulated, as to have been absolutely destructive of animal life; the great and wise Author of our being has so ordained, that the impure air shall not only be attracted by the seas, rivers, and vegetables, but that the latter shall exchange it for, probably convert it into, pure air, fit for animal respiration.

As the blood undergoes a very considerable degree of pressure and agitation in the lungs,
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its principles are thereby more intimately mixed; and some suppose that they impart the red colour to the blood.

There is a peculiar connection between the heart and lungs, not only from their contiguity, but from the great quantity of blood, (being nearly half of the whole mass) which passes to and from the lungs with great rapidity; hence the heart and lungs are mutually and powerfully disturbed by the morbid affections of each, those especially accompanied with fever. Air blown into the lungs of a dog by a bellows, restored the motion of the heart after it ceased; a proof that respiration and circulation are intimately connected.

The proportion of inspirations to the pulse is about one to four: strong exercise, and all other stimulating causes, quicken the respiration and the pulse.

Sneezing and cough are convulsive contractions of the muscles subservient to expiration, excited to discharge some irritating cause; so is vomiting and hiccup: yawning is a protracted inspiration; laughter, sobbing, and sighing, are efforts of respiration.

§. 57. The air being the *natural stimulus* of the lungs, the purer and heavier it is, it is fitter for respiration, and therefore we always find ourselves more lively and alert in a pure air; and the very ingenious Dr. *Priestly* informs us, that his breathing and feelings were remarkably pleasant, when he breathed that kind of factitious air which he calls dephlogisticated, which is much purer than the common atmospheric air; of which not above one third is pure, the remainder consisting of various noxious exhalations from animals, vegetables, and minerals.

From a variety of experiments the following inferences may be fairly deduced.

1st. That common or atmospheric air is probably a particular element, and that the purest kind of it is that which approaches nearest to Dr. *Priestly*'s dephlogisticated air; but that common air can never exist without some accessory substance, by which it is more or less tainted.

2^{dly}. That this accessory substance is of various kinds, and amongst these none more frequent than acid and phlogiston, or the inflammable principle, and that the purest air is that which has least of the phlogiston; retaining,

taining, however, a smaller proportion than usual of fixible air, which is a peculiar acid combined with common air.

3dly. That there is a sensible difference between the air of different places, and even between that of the different parts of the same city, owing to the greater or less prevalence of those substances.

4thly. That nature, as I have before remarked, has carefully provided the means of preventing the too great accumulation of accessory or foreign substances, which always more or less diminish the purity of the atmosphere.

I have, in a former essay^a pointed out the dangerous effects of impure air, and hot crowded rooms; and these effects are so much the more dangerous, as they do not always immediately manifest themselves in the form of disease; and when they do, the disorder is rarely attributed to the right cause.

Each person is supposed to destroy the vivifying principle of a gallon of air in a minute, by the impure vapour which is dis-

charged from the lungs and surface of the body by perspiration: and hence the necessity of frequently ventilating and renewing the air of our apartments, especially if small and crowded.

There occurred, about four years ago, a very remarkable instance of the dangerous effects of foul stagnant air.

Eighteen charity children, and a servant, lay in one apartment of a house in King-street, Golden-square. To render the room warmer, they shut up the chimney, and used every other expedient to exclude the cold air.

The servant and ten of the children were seized with excruciating pains in the pit of the stomach and back, violent head-achs, delirium, and convulsions; all which symptoms could only be attributed to foul air.

To preserve the healths, and amend or confirm the constitutions of the rising generation, is certainly an object of great importance. I have been led to make this remark, not only in consequence of the accident which happened to the charity children, but of what occurred lately in the case of a young lady who was my patient at Bath. Therefore school-rooms, and bed-chambers,
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where a number of young persons are crowded together, ought not only to be spacious, but well ventilated; and I do most earnestly recommend to the masters and mistresses of boarding-schools a due attention to this circumstance; and to parents, that they enquire into the manner in which their children are accommodated in this respect.

The same precaution is necessary with respect to nurseries; especially, as servants are, in general, both from habit and prejudice, fond of hot and close apartments.

From what has been said concerning the weight of the air under the preceding section, we can account why people who are asthmatic, or have their lungs otherwise weak, are liable to be affected by changes of weather. *Monsieur de la Condamine* tells us, that the Spanish and French academicians, who were appointed to measure a degree of the meridian near the equator, on ascending the very high mountains of *Quito*, found themselves so much incommoded by the lightness of the atmosphere, as to have violent pains in the internal ear, and discharges of blood from their lungs. As the mercury of the barometer stood then at 16, the weight of the atmosphere was lessened.

sened nearly 1500 pounds; and the resistance to the propulsive power of the heart being so much diminished, the blood was forced through the arteries into the air-cells of the lungs; and the air of the internal ear was very much rarefied. *Da Costa* experienced the same effects, but in a higher degree, when he crossed the *Andes* some years before. Some experiments made in air-balloons seem to confirm these instances of inconvenience from breathing in higher regions of the atmosphere.

The vivifying principle of the air has been supposed to depend on its elasticity; and that in air unfit for breathing the elasticity is much lessened; but this is not the sole cause; for though the fumes of burning sulphur, charcoal and candles, the vapours of fermenting liquors, the inflammable air discharged by heated metals, the damps of mines, the effluvia of paints, the putrid exhalations from animals and vegetables, strong odours or perfumes, and even the breath and perspiration of persons crowded in rooms not duly ventilated, diminish the elasticity of the air; yet this is rather an accidental effect than the true cause of its being unfit for breathing. It should seem that the noxious effects of air, impregnated

nated with these vapours, proceed from their being so saturated with mephitic matter as to be unable to combine with and carry off the noxious matter generated in our bodies; and partly from their sedative qualities, inducing a kind of paralytic weakness of the nerves of the lungs.

Infant man does not breathe before his birth.

The only organ contained in the cavity of the breast besides those already described, is the *Thymus* gland, the use of which is not well known: it is largest in the infant, and gradually decreases in size. The cavity of the breast is pretty nearly divided into two equal portions by a double membrane, which extends from the spine to the breast bone; so that the right lobe of the lungs is separated from the left by this membrane.

§. 58. *The Voice, or Articulation.* The upper part of the larynx has several small muscles contiguous to that opening through which the air passes into the lungs: by these muscles this chink or aperture is enlarged or contracted, so as to produce the various gradations between the most grave and acute tones.

tones. The tongue, palate, lips, and teeth, contribute very considerably to modulate the voice.

The *Glottis* is the chief instrument of the voice, which is uttered by the tremulous vibrations of the ligaments of this curious aperture; the larynx being elevated in acute sounds, and depressed when grave sounds are uttered. There are many curious circumstances respecting the voice, its tones, and modulations, and the pronunciation of letters and words, which my necessary brevity obliges me to omit.

The human voice is far superiour to that of other animals, and to the most perfect musical instruments, not only in diversity of tones, but in melody.

We are as much distinguished from each other by difference of voice as of countenance; and various useful purposes are answered by these strong marks of distinction between man and man. Some persons are endued with a faculty of throwing their voices into particular directions; and hence various ludicrous incidents and mistakes from the exercise of this art by *ventriloquists*.

§. 59. *Morbid Affections of the Vital Powers.*

In considering this very extensive and interesting subject, I find it difficult to draw a line between that prolixity which would be inconsistent with my plan, and that extreme brevity which must necessarily leave the curiosity ungratified, and the philosophical principles not sufficiently explained.

These morbid affections ought, for the sake of perspicuity, to be arranged under different heads.

1st. All the organs of vital motion, composed as they are of simple cellular and muscular fibres, must be liable to all the affections enumerated §. 4.

2^{dly}. Animated as these simple fibres are by an intermixture of nerves, which impart the faculty of sensation and power of motion, we may easily conceive that they must be subject to all the nervous affections enumerated under §. 9, and to those of the muscles, §. 12. But as many of the organs of circulation and respiration are cavities and tubes of different dimensions, and adapted to various purposes, they must, as such, be subject to manifold deviations from the healthy state, in consequence of various faults of their natural

tural stimuli, from their becoming preternatural or morbid.

To explain these to any but medical readers is very difficult; because the names of the diseases which ought to be adduced as the strongest examples, are not familiar to any others: I shall, however, select such as are most intelligible.

3dly. All the organs of the body may be constitutionally weak; and hence it is that persons of delicate habits are seldom well, because the œconomy of their health is disturbed by very slight causes: or the body may be weakened by former diseases; and therefore it is that persons who have been ill of fevers, convulsions, or other diseases, are very apt to relapse before their healths are perfectly re-established.

4thly. The natural stimulus may disturb a sound body by its bulk stimulating the heart too much; as when young persons full of blood are short breathed on exercise: or by its pungency; either in consequence of heat, as when the blood is over-heated by violent exercise, strong drink, &c. as will be farther explained under *Morbid progressive Motion*; or by its qualities being depraved by

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infection or acrimony; as when gouty matter, repelled from the foot, falls upon the heart, lungs, &c. as will be explained under *Morbid intestine Motion*.

5^{thly}. Some part of the natural stimuli may be so gross as to plug up, as it were, some of the cavities; as happens from congealed blood, or rather serum or lymph producing polypuses in the cavities of the heart, lungs, and large blood vessels—shortness of breath and cough from gross phlegm in the air-cells of the lungs; or a particular kind of asthma of stone-cutters, from the particles of stone inspired by the lungs.

6^{thly}. The cavities, whether previously weak or not, may be burst, either by the quantity, or the forcible motion, of the natural stimuli: Thus his late Majesty expired instantly from a bursting of one of the cavities of the heart; aneurisms of large arteries have also burst, and destroyed the patient; and the smaller arteries may either be rent asunder in their sides, or their orifices forced open, and the blood discharged. Hence various discharges of blood from the lungs, nostrils, stomach, bowels, kidneys, &c. besides various discharges of blood into the cavities

cavities of the head, breast, and belly, from whence there are no outlets.

7thly. These organs may also have their structure much injured by hard bruising instruments; and hence very dangerous diseases, and sometimes sudden death, from severe blows on the head, breast, &c. the effects of which may, in some degree, be exemplified in a common bruise on the surface of the body, where, from the dark colour of the bruised organ, it is evident that a considerable number of small vessels have been burst, and the blood effused under the skin.

8thly. The organs may have their structure destroyed by wounding instruments; and the nature of such an injury sustained by the heart, lungs, and other great organs, in which it is generally fatal, may be easily conceived from the appearance of a wound in one of the limbs.

9thly. They may also have their substance partly destroyed by sharp or corrupted matter lodged upon them, in consequence of inflammation, bruise, wound, or bursting of blood-vessels, as may be seen in external ulcers or sores of any kind: Hence the substance of

the heart has sometimes been found ulcerated; and ulcers of the lungs, commonly called *consumption*, sometimes occur from inflammation of that organ, spitting of blood, &c. and the same happens from similar causes in the stomach, intestines, kidneys, &c.

10thly. The natural stimulus may be so deficient in quantity as not to excite the organs sufficiently for a vigorous and steady performance of their functions: hence a sense of sinking, languor and faintness at the heart, in consequence of large evacuations of blood or other humours; in which the lungs partake so much, as that a person scarcely breathes at all during a swoon: hence also the sense of weakness about the heart, in persons who have long been in a bad state of health, as is evident from the weakness of the pulse, which shews that the circulation is very languid, from the blood being not in sufficient quantity to distend and stimulate the heart.

Before I proceed, I shall offer a remark on what are by some supposed to be two great causes of nervous affections; and which would have been premature, when treating of these morbid affections §. 9, and 12.

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§. 60. That the nerves may perform their offices properly, it is necessary that they should be preserved in a due degree of what may be called *tension*; that is, that they should be so supported by the cellular membrane, the muscles and blood vessels, and the coats of the hollow organs, as to be kept gently on the stretch. I would not infer from this term, that they are elastic in any great degree, like musical cords; but persons who are subject to nervous complaints often express their ideas of their feelings, by saying that their nerves are *wound up* to a disagreeable pitch; or that they are, on the contrary, *unstrung*; though the analogy is not strictly accurate.

Besides many other examples of *over-tension*, which might be given, I shall only mention one.—A patient of mine was subject to epileptic fits, brought on by intemperance: so long as he lived temperately, he had no fits; but they returned when he exceeded either in eating or drinking, or was disturbed by passion. Here an accidental fulness, either of the whole system of blood vessels, but chiefly those of the stomach and head, by overstretching the nerves, excited the con-

vulsion. On the other hand, we know that when nervous affections are owing to the nerves not being kept in due tension, (which is the most frequent cause) hysterical and hypochondriacal patients often complain of a sense of hollowness, sinking, and emptiness; —a most disagreeable sensation. I know a hypochondriacal patient, and there are thousands in the same state, who suffers exceedingly if he does not eat frequently, or if flatulence wanders from one portion of the bowels to another; or he is seized with a small degree of purging: and Baron *Van Swieten* records the case of a delicate girl, whose nerves were so irritable, that they were obliged to swathe her from her neck to her toes, for the purpose of giving due *tension*, firmness, or support, to the over-relaxed nerves, and supply the defect of that regular tension which they have in persons of a firm state of fibres, strong muscles, and a steady circulation; and it is for this reason, probably, that persons of a firm temperament have seldom any excess of bodily sensibility. From what has been said, we see that morbid affections of the nerves may arise from two opposite causes.

And

And now we are on this subject, it may be observed that persons of a gross habit, having a less degree of sensibility, may be owing to the cellular threads being in them of a grosser texture than in the delicate temperament, and from oil, or a grosser serum than usual, being discharged into the cellular interstices, and thereby not only blunting the impressions made on the nerves, but sometimes interrupting the communication with the brain. Of this we have an instance of scirrhus or hard swellings of the glands of the breast, which, so long as they are in that state, are almost totally insensible; and the same happens in the stomach, lungs, &c.

§. 61. From what has been said in the preceding pages, it may readily be conceived, that as the circulation of the blood is the great source of life; so, many important diseases must be produced when it deviates from its natural state. This deviation may take place in various ways.

1st. Its *progressive* or direct motion from the heart, through the arteries, to every part of the body, and back again through the veins to the heart, may be *too great*, strong, and

and rapid, of which the simplest idea we can conceive is what happens to a person after running some time. The pulse becomes more quick and full than usual, he breathes hard, and is hot: that is, he has a fever, which will continue and increase so long as the exercise is continued, and for some time afterwards. How are we to account for this change? Simply by saying, that, by the strong and quick contractions of the muscles employed in moving the limbs, the veins which are contiguous to those muscles being strongly pressed by them during their contractions, the motion of the blood through the veins is increased; more blood than usual is returned to the heart, and it must necessarily contract more strongly, or more frequently, or both, that it may empty itself as often and as quickly as it is filled; otherwise it must be, as it were, overflowed, and its motion stopped altogether, as is often the case with horses in hunting, which drop down dead; and has sometimes happened to men during violent exertions. This temporary fever may become a continual and fatal fever; as has happened frequently to persons who have used violent exercise.

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Here the natural stimuli of the heart, the bulk, motion, and heat of the blood, being all increased beyond their due proportion, they are converted into morbid stimuli. The same happens with respect to excess in the use of strong drinks, spiceries, animal foods, &c. all of which, as we daily experience, create a fever by the stimulus they impart to the heart through the stomach, which fever generally goes off in a few hours; but sometimes becomes a real disease.

2dly. The progressive motion of the blood may become too weak, languid, or slow, from the power of the heart and arteries being weakened by disease; and therefore not able to contract with their usual vigour. This state of the circulation is opposite to the former; and such persons are pale, weak, and languid, and the pulse is sometimes soft and slow, but often weak and quick.

This difference in the pulse should be explained.

In some diseases the body in general has so much less sensibility than it ought to have, that the heart and other organs labour under a kind of palsy; and hence we can account for the pulse being slow; but in general

neral the pulse, though weak, is quicker than in health, owing to the nerves of the organs being rendered too sensible or irritable by disease; and the heart being in this state, it contracts more frequently to push on the blood, because it wants strength sufficient to discharge so large a quantity at once as it was wont to do in health. This accounts for the quickness of the pulse; and its weakness proceeds either from so great a quantity of the blood being exhausted by disease, that it cannot fill, distend, and stimulate the heart as usual, and perhaps also from its not being so hot, dense, and pungent, as in health. (See §. 59, p. 132.)

Hence in this state physicians are often obliged to give such medicines, and direct such diet, as may increase the natural stimuli, or, in other words, produce an artificial fever.

§. 62. *Intestine Motion of the Blood.* I hinted, §. 55, p. 110, that some physiologists were of opinion that the ammoniacal salt, and the air contained in the blood, produced a kind of fermentative motion between the particles, which conferred upon them a kind of vital principle,

principle, and perhaps contributed to support their heat and fluidity.

This opinion is not improbable; at least something like it takes place in disease; though the term *fermentative*, borrowed from the working of fermenting liquors, is not accurate; but we are often, from a defect of language, obliged to make use of remote analogy. The truth is, that the manner in which some of these changes are produced is as inexplicable as it is wonderful: I shall illustrate this matter as simply as I can by an example.

A person is inoculated with an exceedingly small particle of matter taken from a patient in the small-pox, which is sucked in or absorbed by a lymphatic vein, and carried into the blood. What is the consequence? It is mixed with the whole mass of blood, and at the end of seven or eight days various symptoms come on, which shew that the nervous system and the heart are affected by some morbid stimulus, and almost every organ of the body is disturbed by nervous and feverish commotion.

By what means, or rather, by what change, is this disturbance in the whole system produced?

It should seem that the matter, mixing with the whole mass of humours, imparts to them so much of its own nature, as to produce eruptions on the skin, similar to those on the person from whom the matter was taken. This change we call *assimilation*, or a change by which one thing being mixed with another reduces it to its own nature; as a small quantity of yeast will ferment a large quantity of wort.

Is the whole mass changed in the course of eight days into a variolous nature? So it should seem, from the learned and ingenious Professor *Home* having inoculated a child with the blood taken from another in the measles.

It should seem, therefore, that a certain space of time is required for the compleat assimilation of the blood by the contagion.

In this way only we can account for a contagious disease being conveyed from a diseased to a sound organ, by the subtle effluvia being sucked in by the pores of the lungs, and the passages into and through the stomach, and mingled with the blood; when each specific contagion produces its like, as putrid fore throat, putrid and malignant fever,

fever, plague, &c. and some persons alledge, that nervous fever, consumption, and some other diseases, are actually contagious.

What is the change actually made on the blood by these contagions? In some instances none that is discernible; in others, the texture of the blood seems to be broken down and dissolved, as in putrid fevers.

In these cases, as in the small-pox, a longer or shorter time seems to elapse from the instant of receiving infection, to the time of its breaking out in the form of disease; though if we may credit some accounts of the instant fatality of the plague, it should seem that these infections may act, as it were, instantaneously on the nervous system, and extinguish life with the rapidity of lightning.

The physicians of the last age conceived that many of our diseases arose from the blood being tainted or *assimilated* by admixture of bad foods and drinks; and that thereby various kinds of acrimony, scrophulous, scorbutic, putrid, gouty, &c. were generated. As the intestine motion may be too great, and increase the pungency and perhaps the heat of the blood; it has also been supposed that it may be deficient, and produce

produce a crude, cold, watery, and inert state of the blood, and thereby contribute to defective progressive motion. On this subject I shall make some remarks in the next book.

§. 63. *Morbid Determination.*^h I have remarked, §. 48, that as an equal distribution of the blood to every part of the body is a most essential cause of health; so, when in the course of circulation, too much or too little blood is transmitted by the arteries

^h Though the doctrine of Derivation and Revulsion, as necessarily implying morbid determination, has long been applied to practical purposes in the cure of diseases, or the mitigation of particular symptoms; yet, so far as I recollect, the principle of morbid determination has not, except by myself in a former work,* been formally and pointedly adopted, either for the purpose of explaining many phenomena in diseases, or as a ground for indications of cure; and I flatter myself that, by the extension of this principle, I have rendered this very extensive branch of pathology much more simple and intelligible than it has hitherto been; and the more this principle is examined by judicious readers, they will find it to be exactly conformable to many important indications for the cure of a great variety of diseases; and every man who practises on a rational plan will readily allow, that, provided principles are well grounded, the fewer and more simple they are, the danger of making erroneous inferences will be diminished, and the certainty of success in the management of diseases will be proportionably increased.

* Commentaries on the principles and practice of Physic, which has been long out of print.

to any particular organ, many very dangerous diseases may be produced.

From what has been said on the subject of progressive motion, it may easily be conceived, that when it is too violent, as in fevers, the blood cannot be equally distributed; hence the great flushing of the face under violent exercise and high fevers; on the other hand, when progressive motion is weak, determination must be irregular; an instance of which we have in dropfical and other cold swellings.

The proportion of blood sent to each organ does not so much depend on its bulk, as on its peculiar structure, nature, and functions.

Thus the lungs, though not equal in bulk to one-sixth part of the body, circulate as much blood in the same space of time as all the rest of the body; and Baron *Haller* computes that the brain receives one-third of the whole mass of humours, though its bulk is only one-eighth of the whole body. It has been already observed, that the blood does not flow with equal force or velocity to every organ.

Morbid determination may be owing to lessened or increased proportion of blood sent to each organ; and this may be either sudden or slow: I shall make a few remarks on determination suddenly diminished or increased under this section, and shall reserve my observation on the other species for the next book.

Suddenly diminished determination is a very frequent and powerful cause of diseases.

To understand how this happens, it should be observed, that, as all the vessels which circulate the blood constantly accommodate their cavities to their contents, so as to be always full; therefore, should any considerable number of those vessels suddenly contract, or lessen their cavities, so as not to admit their usual quantity of humours, all the arteries between these obstructed vessels and the heart must have more blood in them than is natural; they must be overfilled, and in a state of morbid tension.

Let us now take a familiar example to shew what will be the consequences.

A person is exposed to rain or cold wind; what will ensue? It is probable that not only the open mouths of myriads of perspiratory
arteries

arteries which open under the scarf skin, and into the air-cells, and are constantly pouring out a fine fluid, will be shut up; but those vessels may, for a considerable depth beyond their orifices, and nearer to the heart, be so narrowed or constricted in their cavities as to allow very little, if any, of their humours to pass through them. The progressive motion of the blood being thus checked in an infinity of small arteries, and the blood continuing to flow into the heart from the veins, this grand organ must either be so distended by the returning blood, as to be totally unable to contract, and death must ensue; or it must act with redoubled force and frequency, not only to push on the blood in its cavities, but to overcome the resistance in the constricted arteries; or, in other words, produce a fever. How may this struggle of the heart to restore the balance of circulation terminate? In various ways. Either the constricted vessels may be forced open, and, perspiration being restored, the circulation become free; or if the resistance be so great as not to be overcome, the tumultuous torrent may be *determined* on the membranes of the nose, throat, and wind-pipe,

and produce a thin discharge from their perspiratory vessels, which is vulgarly called a *cold*; or the perspiratory vessels of the lungs being more yielding than those of the skin, may empty themselves very copiously, as it were by a sweat; or the surcharge of humours may be thrown on the kidneys, or bowels, and be carried off by increased secretion of their fluids.

In one or other of these ways the constitution may relieve itself, and the tumult necessarily ceases; when the vessels of the skin at length relax, and compleatly restore the equilibrium.

This leads to the consideration of

§. 64. *Fever*, the nature of which will not now require much explanation. We have seen that suddenly diminished determination may produce different kinds of suddenly increased determination; and we proceed to shew in what way it may produce others.

If the patient be not relieved in any of the ways just mentioned, *the fever is formed*. We know from experience, that if the suddenly diminished determination is considerable,

able, the constriction of the vessels, which is a kind of nervous spasm, generally produces an ungrateful sensation in the nerves of the obstructed vessels, called rigor, chill, or a sense of cold; and some are of opinion, that this is the commencement of every fever. Within a shorter or longer space, the chill is succeeded by a sensation of heat; the pulse quickens and becomes more full; painful sensations are excited in different parts of the body, and the patient becomes restless, watchful, and thirsty.

This is a plain description of a simple fever. What may be the issue of this fever? After a few days, in consequence of the repeated efforts of the heart, it may be terminated safely by an increase of perspiration into sweat; or by some of the discharges from the lungs, bowels, or kidneys, being increased; or by a bleeding from the nose.

But if it does not end soon in one or other of those ways, the danger increases hourly; and the force of the circulation is diverted from those outlets which the efforts of the heart could not open, upon some of the nobler organs, *especially the brain*, where a dangerous and often fatal change may be

produced, the nature of which will be explained under inflammation.

Let us suppose now, that instead of the vessels being constricted by cold, this effect were produced by the ungrateful stimulus of some one or other of those contagious effluvia mentioned under the section of intestine motion; a similar febrile struggle takes place; but from the noxious quality of the cause, the nervous system and vital powers being very much and suddenly weakened by the poison of the malignant or putrid matter, the constitution is less able to relieve itself; and the disease often becomes fatal, either by morbid determination on some of the chief organs, or by destroying the vital and nervous energy.

Many of these infectious fevers, beside small-pox and measles, have a tendency to the surface of the body, in the form of eruptions, as St. Anthony's fire, scarlet rash, miliary rash, purples, carbuncles, &c. and much of the danger consists, either in the constitution not being able to give the poisonous matter a determination to the surface, or from its falling back again upon some of the principal or vital organs.*

* See next Essay near the end.

I shall conclude this section by some remarks on the different types and periods of fevers.

The most simple fever is that of a few hours, when the constriction is not great, and is therefore easily overcome.

The next in degree of mildness is the intermittent, or ague; when, after a few hours, the fever goes off, and returns at stated periods.

If the fever does not totally intermit, but only abates, it is called a remittent; and so universally prevalent is this tendency, that there is no fever, the intermittent excepted, that does not remit at one time or other in 24 hours, but generally in the morning.

Another distinction of fever is its being high or low; that is, inflammatory or nervous; but there are various degrees between these two extremes, which none but the judicious physician can discern. Of the nervous there seems to be two kinds diametrically opposite to each other: one in which the sensibility is extreme; another in which the patient seems to lie in a stupid or apoplectic state from the beginning to the end: The latter is not so frequent as the former;

but it is apt to change into it, when it becomes dangerous or fatal.

Fevers are apt to change their nature; that is, the inflammatory may become nervous or putrid, the intermittents may become remittent, or the remittent may intermit.

There are many other curious and interesting circumstances respecting fevers, which I cannot enter upon.

§. 65. *Inflammation.* After what has been said under the foregoing sections, this most important morbid affection will not require a very diffuse explanation, if sufficient attention has been paid to what I have remarked on the manner in which the minute arteries correspond with the veins.

The red arteries, after sending off their blood into red veins, send off ferous arteries, which separate a humour thinner than the blood, and of a yellowish colour.

The simplest mode of explaining it, is to derive the information concerning its nature from the appearance and progress of a boil, or a whitloë; which every old nurse pretends to understand; but of which they really know nothing.

A swelling

A swelling appears, which is red, hot, and painful: How do we account for these circumstances? The current of the blood may be determined on the red vessels of the part, by any cause which stimulates those red vessels to contract more forcibly on the blood they contain. What that cause is, it is not always in our power to explain, though the fact is indubitable. What happens? The red arteries act more violently than in health, in so much that the irritation forces more blood towards the veins than they can receive readily, so that not only more serum, but sometimes particles of red blood, are forced through the lateral vessels into the surrounding cellular membrane, by their mouths which open into it. Hence we can account for the swelling, the redness, and the pain. After this mixture of blood and serum has stagnated there some time, what is the event? It is various: sometimes these fluids are sucked up by the veins, and carried into the circulation, and the boil gradually becomes less swelled, red, and painful, and at length disappears; more frequently by stagnation and heat, the fluid is converted into matter, and is discharged; and, though rarely,

rarely, the nerves and blood-vessels are so compressed and suffocated, as it were, by the quantity or sharpness of the matter, that they lose all sensation and motion, and the part becomes gangrened or mortified.

What happens to an insignificant swelling, the progress of which is obvious to the senses, happens to the heart, lungs, and every other internal organ; and the judicious reader need not be told that, on account of their size, situation, and great importance, the danger must be proportionably greater.

It is worthy of observation, that even a whitloe, or a number of boils, shall, by sympathy, extend the painful stimulus to the heart, and produce fever; how much more severe therefore must that fever be, which is excited by inflammation of a large and very sensible organ?

Inflammation, therefore, may either begin in a particular organ, as in the instance now given; or it may be an effect of morbidly increased determination upon one or more organs, in consequence of any or all of the kinds of fevers mentioned above; and which, as I remarked before, is the chief cause of their danger and fatality.

§. 66. *Hæmorrhage*, or morbid discharge of blood, forms a most important class of diseases.

1st. It may proceed from wounds or bruises. (See §. 59, No. 7, p. 131.)

2^{dly}. The arteries may be so tender and weak, and their orifices or open-mouths so much relaxed and widened, as to allow the blood to run through them: Hence the blood is discharged from the nose or lungs of very weak persons; and generally so thin and watery, as scarcely to tinge a white handkerchief.

3^{dly}. In putrid fevers, and sea-scurvy, the blood is sometimes so melted down, as to settle under the skin in purple spots; and to be discharged from the lungs, stomach, bowels, skin, and *even* from the corners of the eyes.

4^{thly}. But the most frequent and dangerous is that which proceeds from increased determination and fever, the consequence of suddenly diminished determination in some other part of the body; as in apoplexy, spitting of blood, dysentery, &c.

§. 67. The

§. 67. The muscles and membranes of the larynx are subject to all the diseases of other organs, §. 4, 9, 12, and consequently may be relaxed, constricted, inflamed, &c. by which the voice may be variously affected, or totally lost.

Persons born deaf, cannot articulate words, unless instructed; and even then their voice is harsh and monotonous, as it cannot be regulated by the ear.



B O O K IV.

O F T H E N A T U R A L F U N C T I O N S .

C H A P . I.

Of the Natural Functions—Organs of Mastication—Deglutition—Stomach—Digestion—Experiments on the Digestion of Brutes—Causes of Digestion—Instances of extraordinary Appetite—Hunger—Instances of extraordinary Fasting—Thirst—Instances of the fatal Effects of Thirst—Changes of the Food in the intestinal Canal—its conversion into Chyle.

§. 68. **T**H E *Natural Functions* are various; for besides those which are enumerated in the contents, the secretions and excretions are also natural functions, and will be considered in the next chapter.

As the body is constantly undergoing a waste of its solids and humours in consequence of the necessary exercise of its functions;

tions; it is indispensibly necessary that this expence should be supplied in a degree adequate to the waste. This supply is afforded by *aliment*, or meats and drinks.

§. 69. The solid parts of our foods ought to be divided, not only for the purpose of swallowing them with more safety, but that they may be more easily prepared into nourishment by the digestive powers.

Mastication is performed by the *teeth*; which when they are compleat, are sixteen in each jaw, fixed firmly into bony sockets, and supported by the gums. Each tooth is supplied with an artery, a vein, and the branch of a nerve.

The teeth being of different forms, some are fitted for dividing, others for grinding solid foods; and they are better suited for these purposes by being covered by a hard enamel.

The lower jaw being supplied with a variety of muscles, they open and shut the mouth, and press the teeth, in different directions, against the solid food, which is directed towards them by the lips, tongue, and cheeks, which are supplied with muscles
for

for that purpose, and for the modulation of the voice.

§. 70. *Deglutition.* During *mastication*, the food is softened by the *saliva* and other fluids, to be taken notice of hereafter, and being reduced into a soft pulp, is thrust over the tongue into the *pharynx*, or gullet. It is prevented from entering the larynx, by the *epiglottis*, which covers that passage; and cannot pass into the nostrils, the opening into which, from the throat, is at that instant shut up by the veil of the palate. It happens however, from a defect of those organs, or want of caution, that some portion of food or drink does deviate into one or the other, by which some inconvenience, and even danger, may be incurred.

The *Pharynx*, or gullet, is a membranous bag placed behind the larynx, which is supplied with muscles to direct and press the food downwards into the *æsofagus*, which is a tube which, passing down the back part of the breast, and through an opening of the midriff, is expanded into the *stomach*, which is extended across from the left side beyond what is called the pit of the stomach. To the

the stomach, at its right end or orifice, is joined a long canal or tube, which, by a number of turnings and convolutions, occupies a very considerable part of the cavity of the *abdomen* or belly, and terminates at the lower part of it. The *intestines*, though a continued canal, have been divided by anatomists into six portions, to each of which they have assigned a name.

The *Stomach* and *Intestines*, by means of their muscular fibres, perform a gentle wave-like motion, called *peristaltic*.

Man, and carnivorous animals in general, have but one stomach; in some of the ruminating animals there are four stomachs; and in others, and in many birds, there are three; others, as the eagle and other carnivorous birds, have but one; as also the horse, elephant, &c.

This continued canal, extending from the throat downwards, is nearly of a similar structure, consisting of several layers of membranes interspersed with muscular fibres, and supplied with nerves, arteries, and veins; and many of the finer arteries, opening into the cavity of the whole canal, are constantly pouring out a fine fluid called the *gastric* and *intestinal lymph* or juice.

§. 71. *Digestion.* When the aliments and drinks arrive at the *stomach*, they, by their bulk, weight, and other qualities, stimulate the nerves and small vessels, which are thereby excited to pour out the humours more copiously; whilst the aliment undergoes a gentle agitation, by the united means of the peristaltic motion of the stomach and bowels, and the action of the intercostal and abdominal muscles in respiration.

To these agents of digestion, we must add the natural heat of the body, equal to 96 degrees, by which the air contained in the alimentary mass is extricated, and breaks the texture of the solid foods; whilst the saliva, which is swallowed with the food, contributes its share in completing the process, so far as respects the stomach; for the intestines have a very considerable share in preparing and assimilating our foods to an animal nature.

I proceed to make some remarks on the important function of *digestion*.

Our foods and drinks, together with the saliva and gastric juice, are the natural stimuli of the stomach; and it is evident that their quantity and qualities should be such,
as

as that their stimulus shall neither exceed, nor be deficient, for the purpose of perfect digestion.

Various opinions have been held concerning the nature of digestion. The mathematical physiologists attributed it chiefly to the muscular power of the stomach and the abdominal muscles, which they estimated at many hundreds of pounds; but the calculations were erroneous.

It is certain, however, that the contractile power of the muscular coat of the stomach is considerable. The upper and lower orifices certainly contract so closely as not to allow the thinnest liquid to pass; and even the middle portion of that organ contracts its diameter to the quantity of its contents, and assists in discharging them upwards or downwards. Some foods are retained longer in the stomach than others; and in Essay III. some account will be given of the relative digestibility of foods. In general, the stomach is empty at the end of the seventh hour after eating; and we judge of the emptiness of the stomach from the return of hunger: the *Mexicans* digest more rapidly, for they are in danger of fainting if they fast
more

more than three hours after a meal: some persons of rapacious appetites have, on dissection, been found to have stomachs of a small size, and which therefore became sooner empty.

From some experiments made out of the body, it is inferred, that digestion is performed by a fermentation not very different from that by which wines and beers acquire their intoxicating quality, and that during this fermentative process a considerable quantity of fixible air is separated from the aliment, which in its escape contributes to the solution of the other principles of which it is the chief cement; but is again partly united with them before they mix with the blood. It is supposed that when the digestive fermentation is perfect, it is *vinous*, or of the nature of wine; when imperfect, the contents of the stomach become sour or acetous, or alcalescent or tending to putrefaction.

It is certain that, in some other animals, the food has a strong disposition to acescency; and from Sir *John Pringle's* experiments, it appears that animal foods readily ferment with saliva; to which we may add, that both iron and brass have been corroded in the

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human

human stomach, owing, it is supposed, to an acid generated there: In man sometimes, and generally in carnivorous animals, the contents of the stomach acquire a putrid nature. Thus in a man whose stomach retained the food for twenty-four hours, and rejected it by vomit, it was found to be quite putrid; and the breath of the lion, eagle, hyæna, and other carnivorous animals, seems to approach to a putrid nature. This opinion of food, even vegetables, putrifying in the stomach is very ancient, and was held even by *Hippocrates*; and it was generally, but erroneously, deemed a necessary part of the process of digestion; for I believe it never takes place to any considerable degree in the healthy state of the stomach.

It is an extraordinary fact, that not only the human stomach, but those of brutes, absolutely sometimes generate a vapour which will take fire, as in two instances of oxen; and in a woman dissected by *Ruyfch*, a vapour issuing from the stomach caught fire when a candle was brought near it. In dram-drinkers the breath is said to take fire sometimes; and an Italian Countess is said to have been totally consumed, one hand excepted,

excepted, in consequence of drinking inordinately of spirit of wine.

From some later experiments, however, made on man and other animals, it appears that this doctrine is not strictly just, when applied to healthy digestion; and as it may amuse the reader, I shall give a brief detail of the result of those experiments by which a more exact idea of the general nature of digestion may be obtained.

1st. In such of the bird kind as have gizzards, digestion is performed by the muscular force of the stomach, which is very great.

2^{dly}. In the birds which have membranous stomachs, and live on insects, and in beasts of prey, digestion is chiefly performed by the gastric juice.

3^{dly}. In ruminating animals, as the ox and sheep, the food, after being some time in the stomach, is thrown back into the mouth, and undergoes a second mastication, and is afterwards digested by the humours of the stomach.

4^{thly}. Animal food is not digestible by those animals which live solely on vegetables; nor vegetables by those whose natural food

is of the animal kind; but some domestic animals, as the dog, hog, and duck, can digest both.

5thly. The human stomach, when in a healthy state, digests both, but without any fermentation; and the gastric juice has a power of correcting and resisting both acidity and putrefaction; and though the inner coat of the stomach in man and all other animals has a peculiar power of curdling milk, yet this does not seem to proceed from an acid; and from some experiments it seems to be rather of an alkaline nature.

The quantity of gastric juice discharged into the stomach is very great: it has sometimes been discharged from the stomach by vomiting to the quantity of three and even five pounds, and in one patient sixteen pounds were discharged in the course of a few hours.

Even whilst the food continues in the stomach, some of the finer parts of it are carried into the circulation, and nourish the body. Of this we have undoubted proofs, not only from hungry persons being invigorated soon after the food is received into the stomach; but from what has happened in some deplorable and incurable diseases of the stomach.

Thus

Thus of two persons, the lower orifices of whose stomachs were entirely contracted by a scirrhus, and who consequently vomited up their food again; one survived eight years, and the other twenty, in this state.

It appears, therefore, from what has been said concerning the process of digestion in the healthy, and even in the diseased stomach, that the gastric humour is not the sole agent in digestion; but that it is assisted by the saliva, and even by the mucous or slimy matter, which is separated by the glands of the stomach, to defend its nerves from being too much irritated by any matter we may swallow; and by the contractile force of the stomach, which is not inconsiderable;—that the saliva is peculiarly useful, and therefore those who expend it either by chewing or smoking tobacco, injure the digestive powers of the stomach very much; and that an acid never does prevail in a healthy state of the human stomach. From the highly dissolvent nature of putrefaction, it is not however improbable, from some experiments, that a change of the food, approaching somewhat to putrefaction, may take place *even* in the stomach, but more compleatly in some por-

tion of the intestinal canal, especially after the digestion there has been compleated; and if to these we add the moderate degree of 96 degrees of heat, we have all the probable causes of digestion united, so far as depends on the stomach.

So exquisitely sensible is the stomach, that some authors have considered it as the seat of the soul. *Van Helmont* placed the soul in the upper orifice of the stomach; and some others have supposed it to be the great center of sympathetic communication between the different organs of the body.

Some persons have enormous appetites: the Roman emperor *Maximin* could, it is asserted, eat 20 lbs. at a meal, and his muscular strength was in proportion. The noted strong man of *Issington* required thrice the proportion of food necessary for an ordinary man. But this is not always the case; for I have known several very strong men whose appetites were very moderate.

Sanctorius, an Italian physician of the last century, discovered by experiments that there was an intimate connection between digestion and perspiration, as I shall explain more fully in the next chapter, and in the Essay on Regimen of Diet.

§. 72. *Hunger* is a painful sensation in the nerves of the stomach, produced, as some think, by the friction of one part of the inner coat against another. The Supreme Being has not left the support of life to our discretion, but has implanted in us appetites, which, by the intolerable feelings they excite, force us to procure the means of allaying them.

The waste of the body of a middle-aged man in twenty-four hours, is supposed to be nearly equal to seven pounds, therefore it is necessary that the supply should be in proportion, a considerable part of which ought to be drink.

Of those persons who have died of hunger, the youngest and most robust have perished soonest. The sons of the *Count Ugolini*, who were starved to death in prison at Pisa, died the fifth and sixth days, whilst the Count himself survived to the ninth. A woman who laboured under melancholy, and refused all food, died the thirteenth day. There are many instances of persons fasting voluntarily for a long time. The *Tartars* often fast five or six days; and there is an order of *Greek* monks who do not eat more than

than six meals during the forty days of Lent. Many have survived a considerable time on water alone: the inhabitants of Madura fast for a month at a time; and a person in a consumption lived thirty-five days on water acidulated with a few drops of spirit of nitre. *Johanna Naunton*, a young lady of good family, induced by pride to conceal her extreme poverty, lived seventy-eight days on the juice of lemons; and we are credibly informed, that a Swiss lady existed four months without meat or drink.

With respect to those extraordinary instances of persons who have survived from one to eighteen years without food, and with a very small proportion of drink, this extreme abstinence can only be accounted for, by observing, that they generally laboured under some diseases, which weakened the sensibility both of body and mind.

§. 73. *Thirst* is more intolerable and excruciating than hunger. This appetite for drink is excited to force us to take in a sufficient quantity to dilute our blood. Want of water obliged *Lyfimachus* to deliver up his whole army as prisoners of war; and the

the Emperour *Charles* the Vth lost almost all his army by thirst in the plains of Africa: the dreadful sufferings of the English shut up in the black hole in Calcutta are well known.

§. 74. After the aliment has been retained some time in the stomach, it is gradually pressed out of the lower orifice of the stomach into the intestines by the peristaltic motion; the more liquid parts first, and the grosser last, as was remarked in two persons, who had received wounds which penetrated into the cavity of the belly, by which the contents of the intestine connected with the stomach were discharged. In these cases it appeared that some of the least digestible parts of the food were detained in the stomach from six to eight hours, but it has sometimes happened that particular articles of food have been detained there for many months.

Soon after the aliment arrives in the intestinal canal, it is mixed with the *intestinal lymph*, the *bile*, and *pancreatic juice*, by which it is farther diluted and animalised, by a conversion of the thinner part into a greyish fluid
called

called *chyle*, which is conveyed into the blood by channels to be described in the next chapter; whilst the groffer part of the aliment being gradually pressed forward, by the peristaltic motion, into and through the larger intestines, is at length discharged.

It appears therefore, that though the term *digestion* is commonly applied to the change the aliment undergoes in the stomach, yet the intestines have a very considerable share in that process; nor can it be justly said to be compleated until by repeated circulations it undergoes that ultimate change by which it is fitted for performing the office of nutrition; and, being no longer fit for this purpose, is discharged from the body.



BOOK IV.—CHAP. II.

Of SECRETION and EXCRETION.

Nature of the secreted Humours—Glandular Organs—their Structure—the Liver and Gall Bladder—Bile—Pancreas and salival Glands—Saliva—Mesentery—Lacteals—Chyle—Spleen—Kidneys—Omentum—Milk, its nature and glands—Lymphatic Glands—Mucous Glands—Absorption—Nutrition—Absorbent System—their extensive use explained—Excretion—Organs employed in that function—Perspiration—Sweat—General Remarks on Secretion and Excretion—Qualities of the Body.

§. 75. **S**ECRETION is that wonderful and very important function, by which certain humours are strained off, or separated from, the vessels carrying red blood; which vessels are therefore of a smaller size and dimension than those from which they proceed.

Without entering on a tedious detail of the opinions which have been advanced on this

this subject, I shall endeavour to give the reader a plain and simple idea of the mechanism by which this operation of the system is performed.

It was remarked, Book iii. chap. 1, §. 49, that the red arteries strained off the serum into a smaller order of arteries, which might, strictly speaking, be deemed the first secretion from the blood, but as it is not commonly considered as such, I begin with the next order;—and, 1st, The most simple and universal is, that which is effected by a fine humour passing directly through the openings or orifices of these small vessels. Of this kind is the secretion of a thin fluid into all the cavities of the body, and even the intervals of each fibre, for the purpose of moistening them, keeping them soft and pliant, and preventing their growing together. This simple secretion is so universal, that there is scarcely a point in which it does not take place. In this way a fluid is discharged into the ventricles of the brain, the nostrils, the cavity of the mouth and throat, the cavity of the breast, the cells of the lungs, the cavity of the pericardium, which covers the heart, the stomach, intestines,

tines, and cavity of the abdomen, and finally, into all the interstices of veins, arteries, nerves, and muscles. It is in this way that the matter of perspiration is carried off through myriads of extremely small vessels, which open every where on the surface of the body, and the cells of the lungs. *Lewenboeck*, who was celebrated for his microscopical observations, says, that the perspiratory pores are so small that a grain of sand will cover 125,000 of them.

In the same simple manner, perhaps, but more slowly, the oily part of the blood is separated into the cavities of the bones, into the cellular membrane under the skin, and into particular internal organs, where it congeals into the form of fat. *Nutrition* is also a secretion of this kind.

2dly. Certain organs called *glands* have a more intricate and complicated structure, as consisting of a number of vessels convoluted or wound up together; through which the humours passing in a slow circuitous manner, open at length into one or more cavities, where they deposit their fluid. In these cavities this fluid rests or stagnates, for a longer or shorter time, and undergoes various

rious surprizing changes in colour, consistence, smell, and other properties, not easily to be accounted for, and which certainly has not yet been satisfactorily explained.

The most celebrated anatomists of the last century disagreed in opinion concerning the structure of the glands; but my plan will not permit me to enter into the controversy.

When the secreted humour is of a thicker consistence than the fluid by which it is supplied, the thinner part is taken up by small veins, and carried back into the circulation.

The humours secreted in this way are, the *bile* by the liver, *urine* by the kidneys, *milk* by the breasts, the *saliva* and *pancreatic juice*, which are humours of a similar quality, by the salival and pancreatic glands; the mucous, oily, and wax secretions; the tears, &c. by their proper glands. The *brain* has been supposed to be a gland, destined to the secretion of the animal spirits, distributed through the nerves, for the purpose of sensation and motion; but it remains to be proved that such a fluid really exists. See Book ii. chap. i, p. 15:

I shall first consider those glandular organs which minister to digestion.

§. 76. The *Liver* is a glandular organ of considerable size, seated immediately under the diaphragm, and contiguous to the stomach; and lies chiefly on the right side. It is supplied with an artery for its proper nourishment; but it is a singular circumstance, that the blood, from which the bile is secreted, is conveyed by a vein, the branches of which being extended through every part of the liver, terminate in secretory tubes, which uniting into two canals, one of them conveys the secreted bile to the *gall-bladder*, a membranous bag situated on the back part of the liver; the other proceeding downward towards the intestine, which is connected with the stomach, unites with a duct which brings the bile back from the gall bladder, and enters the intestine a little below the stomach.

It may reasonably be supposed, that part of the bile is deposited in the gall-bladder, and detained there some time for the purpose of its acquiring some necessary qualities.

Bile is a fluid of a brownish yellow colour, of a pungent bitter taste, and of an oily or rather soapy nature; and is discharged into the intestines of an adult in the proportion of about a pound and an half in 24 hours.

The offices of the bile are supposed to be various.

By its *alcalescency* (a quality opposite to that of acidity, and tending to putrefaction) it corrects the acid tendency of our foods, especially vegetables; and as the humours of our body are supposed to be of an *alcalescent* nature, it disposes our nourishment to acquire the animal nature; it assists in dissolving such tough and glutinous parts of our food as have not been sufficiently changed by the powers of the stomach; it blends and unites the oily and watery parts into an emulsion; and it stimulates the bowels to propel their contents.

§. 77. The *pancreatic* gland, called in some other animals the *sweet-bread*, separates a larger proportion of humour than the *salival* glands, which are situated near, and have ducts opening into the mouth.

The *saliva* seems to be a mild soapy humour, and by that quality contributes to the solution of the food, and resembles the gastric and intestinal lymph in its nature. The quantity discharged from these glands is perhaps equal to half the quantity of bile.

By

By these united powers our foods and drinks receive their ultimate and most essential change in the intestines, where they are converted into a bland milky juice of a greyish colour, called *chyle*.

§. 78. The *Mesentery* is a membranous organ consisting of two layers, which on one side is fixed to the back, and on the other to the chief part of the intestines; this double membrane is interspersed with a number of glands. Into the cavity of the intestines, chiefly those nearest to the stomach, a number of vessels called *laëteals* present themselves with open orifices, suck up the chyle, and convey it along the mesentery to a membranous bag in which the chyle is deposited, and convey it from thence to a large vein, and from thence to the heart, where it is mingled with the mass of blood.

The *laëteal* vessels have valves which prevent the return of the chyle, and consequently their office is similar to that of the valves of the heart and the veins; they also communicate with each other, and with the glands of the mesentery, where the chyle is supposed to be mixed with lymph. The

lacteals are supposed to have a power of excluding noxious particles; but this is not always the case, unless they are very acrid and stimulating

§. 79. The *Spleen* is situated on the left side of the stomach. It is divided into a number of cells which receive a considerable quantity of blood, which probably undergoes some change there; but to what purpose is not well understood. This organ has been supposed to be the seat of the hypochondriacal disease, but without sufficient foundation; for what is vulgarly called the *spleen*, is really a disease of the stomach and intestinal canal.

§. 80. The *Kidneys* are situated near the back bone, and supplied with large arteries, which terminate in secretory vessels, by which the watery and saline particles, together with some of the earthy and oily parts of our solids and fluids, are separated, and conveyed by a tube or canal from each kidney into the urinary bladder.

§. 81. The *Omentum*, or cawl, is a double membrane, containing a considerable quantity

tity of fat: It descends from the stomach, to the bottom of which it is chiefly connected, and spreading over the intestines, keeps them warm, and interposes a fluid to prevent their growing together.

§. 82. *Milk* is secreted by the glands of the breast. It is chiefly separated for the nourishment of our infant progeny; but this secretion takes place also in young persons of both sexes; nor is it confined to the breasts; for in infants before birth it is found in other glands, which, after birth, are appropriated to other secretions.

Milk, which very much resembles chyle in its properties, contains a considerable proportion of oil and sugar, a considerable proportion of curd, or coagulable matter, and water,

§. 83. The glands not yet described are,—The glands of the eye which separate the *tears*;—those called *lymphatic* glands, situated in the neck, under the arm-pits, and in the mesentery, and various other parts of the body, which convey lymph, and communicate with a particular system of vessels called lymphatic veins, already mentioned;—the

mucous glands, situated in the throat, and vulgarly called the almonds of the ears, in the nostrils, and in the whole tract of the intestinal canal from the throat downwards, and also in other cavities. These separate a glairy thick fluid, for the purpose of defending those cavities from the sharpness or other stimulating qualities of their contents; and under this head we may bring the mucous glands of the joints, and those which separate the wax of the ears; and an unctuous matter in several parts of the surface of the body.

There is another secretion seldom taken notice of, that of *air*, which is probably received in its fixed state; and in that state discharged from the lungs by every expiration. In disease it is certainly separated in an elastic state, as in gangrenes and mortifications; but whether this be common or fixible air has not been clearly determined; though most probably the latter. Is electric fire to be considered as a secreted fluid?

Having thus briefly enumerated the glandular organs and their secretions, it will be proper to consider the manner in which the body is nourished; this great purpose being effected

effected by a kind of secretion : but that this may be better understood, it may be right to consider another operation of the system.

§. 84. *Absorption*, as the term expresses, implies the sucking up of a fluid. The most familiar way of explaining absorption, is by remarking the manner in which a liquid gradually ascends through the pores of a lump of sugar placed in it. The ascent of liquids, in capillary tubes not exceeding a certain diameter, depends on the same principle as absorption. But absorption is not merely mechanical, for the absorbents are endued with a living principle, as all other sensible and muscular organs are, so that the fluid having once entered their orifices, they, by means of this active principle, promote its progress toward the thoracic duct.

§. 85. *Nutrition*. The solid parts, even the hardest bones, gradually decay, and the particles, thus become useless, are probably rubbed off by the wave of fluid, conveyed by the arteries, containing particles of nourishment, which are destined to supply their place: so that a two-fold change necessarily takes place;

the wasted solids assume, in some degree, a fluid form, and are absorbed by the returning veins; whilst the liquid particles of nourishment supply their place, and acquire a solid nature.

The fluids of the body also become unfit for remaining longer in the body. The oily and saline parts become highly alcalescent, and almost putrescent, by heat and agitation; and therefore, for the safety of the machine, are, together with the useless solids, discharged from the body.

This is the most simple manner in which the function of nutrition can be explained. Some physicians have supposed that nutrition is performed by the nervous fluid; but its existence has been justly called in question.

Absorption is as extensive as secretion; for wheresoever a fluid is deposited, there must be a provision made for its being conveyed back again, after it has answered the purposes for which it was deposited.

Thus the fine fluid which bedews and moistens all the cavities, is absorbed again, and new fluid deposited.

Some of the secreted humours, as the saliva, bile, mucus, wax, and fat, are so much
more

more gross in their consistence than the fluids from which they are secreted; that we cannot otherwise account for this change, than by supposing that the thinner parts are absorbed.

Some ingenious arguments have lately been advanced to prove, that the lymphatics and the lacteals are the only absorbent vessels; and that the common veins are not absorbents. The lymphatics are supposed to convey a fine fluid which is mixed with the chyle in the mesenteric glands.

When the secreted humours have performed the various offices assigned them, they are absorbed and mixed with the common mass of blood.

On the surface of the body, and in the cells of the lungs, an infinite number of veins absorb the moisture from the atmosphere, and with it, probably, some of its active principles.

Some of the benefits we derive from bathing arise from this absorbent power of the surface: Some persons have been nourished by an alimentary bath; and various experiments prove that remedies are absorbed in this way; and the dangerous effects of some
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of those applications shew how cautious we ought to be in the use of them; and how much mischief may be done by powerful remedies in the hands of persons ignorant of the human frame. A plaister of arsenic applied to a scald head killed suddenly; and I have known convulsions and death from a quicksilver girdle applied to cure itch. A decoction of tobacco used in washing the head, brought on vomiting, delirium, and convulsions: a poultice of this plant applied to the region of the stomach, produced vomiting, purging, and delirium. White lead applied to cure a scurfy eruption, brought on shortness of breath, vomiting and fainting. In all these instances the mischief was done by ignorant old women, and equally ignorant and impudent quacks; for when such applications are made judiciously, they are equally safe and effectual: Thus a bitter poultice applied to the belly destroys worms; flannels dipped in hot brandy allay vomiting; and opium applied externally mitigates pain. I have snatched many persons labouring under fevers and internal inflammations from the jaws of death, by the use of the warm bath; and have been equally successful

successful in the use of it in confluent small-pox, and other eruptive diseases. Much of the benefit derived from the use of *our* baths and other mineral waters, arises from a very considerable quantity, perhaps some pounds, being absorbed, and partly from a grateful and lenient impression of sensation excited in the nerves of the skin, and communicated by sympathy to the internal organs. I have cured several children of agues by a bark waistcoat, or a bath made with a decoction of bark.

Hermippus recommends a healthy girl as a bedfellow to an old man; but whatever may be the efficacy of the prescription, I am convinced that health has been injured by sleeping in the same bed with persons labouring under disease; and there is just reason to believe, that many diseases are contracted by infectious effluvia received by the surface of the body, the cells of the lungs, and the passage into the stomach.

§. 86. *Excretion* is the discharge of whatever would, if retained, be useless or injurious.

As the organs of secretion are of various construction, the tubes or excretory ducts which

which carry off the humour which has been secreted must also be different in their construction, diameter, and course, but it is not necessary to enter into these minutiae in this essay.

The chief excretory organs are, the bowels, the kidneys, and the perspiratory vessels of the skin and lungs. What is usually called *perspiration* is a subtile and invisible vapour flying off constantly to the amount of some pounds daily, as has been found by experiment.

If, for instance, we take in eight pounds of meat and drink in a day, five pounds go off by perspiration: But it is very variable, that especially which flows through the pores of the skin, otherwise, if health depended on its being always equal, it is so liable to be checked by different accidents, that we should not enjoy health for a single day. Some physicians have considered insensible perspiration as the most important of all the discharges, whilst others assert that it is not; because there are several nations that stop up the pores by greasy unctions; but it is not clear that it is much checked by this practice, or the defect may be compensated by

by increased perspiration by the lungs. We perspire more during a sound sleep than when awake; and as the body is at rest, the secretion is more natural than when we are awake, especially if we use much exercise, for then the excretion is more gross and crude, and probably carries off with it some of the fine nutritious juices, especially if the person sweats, which is called sensible perspiration, as it comes from the same vessels: sweat always lessens the insensible perspiration, and weakens the body more than any other evacuation.

By these outlets the particles of worn-out solids, and the impure and putrescent particles of the blood, are discharged.

As it is necessary that there should be a certain balance or proportion between the several organs and their natural stimuli; if any of the cavities are over-loaded, or the blood-vessels are too full, the superfluities are carried off either by the natural discharges just mentioned, or by some extraordinary outlet: of the latter, we have an instance in bleeding at the nose, when young persons are very full of blood.

An increase of one excretion may sometimes compensate for a defect of another: Thus when perspiration is checked, the matter falls on the bowels or kidneys, and those discharges are increased; and the reverse. But health cannot be long preserved under this exchange of evacuations, which is always preternatural, and must soon produce disease; because every organ is best fitted to prepare and discharge its peculiar humour.

It need scarcely be observed, that beside those humours which are discharged out of the body as useless and noxious, all those humours which flow from open vessels into all the cavities, and cellular membrane, in every part of the body, are really excretions; and hence a distinction between external and internal excretions. Of this kind is a fine vapour exhaling into the intestinal canal, which is really an internal perspiration, which some have conceived to be converted into flatulence when digestion is defective.

Some have supposed that the electric fluid constantly pervades our bodies, being either absorbed or discharged, so as to preserve an equilibrium; and that disease may be produced by an excess or defect of it. It is certain

tain that our bodies contain a considerable portion of it, and it has sometimes flowed off in visible sparks; and it is asserted that *Christian the IVth of Denmark, Philip the Vth of Spain*, and others, have discharged it this way, when combing their hair, or changing their linen.

Excess of it is supposed not only to have killed an Italian lady, but to have consumed a considerable part of her body to ashes; and an accident which happened lately in France seems to countenance the opinion; the lady was in the habit of bathing with ardent spirit and camphor every night at bed-time.

Before I conclude this subject, I wish to engage the reader's attention to the following curious circumstances.

1st. The surprising difference between our blood, a red fluid, and the humours secreted from it, of various colours, degrees of consistence, and diversity of smell and taste.

2^{dly}. The admirable manner in which the nutritive particles are selected from the whole mass of blood, and distributed to that organ for which it is destined; for we may justly suppose, that a particle fit to nourish the pulpy substance of the brain would be very
unfit

unfit to supply the place of a particle of bone or cartilage.

3^{dly}. The no less wonderful manner in which the useless and noxious particles are separated from the sound and healthy humours by the excretory organs.

Notwithstanding the many ingenious hypotheses which have been advanced in attempting to explain these very curious circumstances, they have been hitherto, and perhaps ever will be, inscrutable.

Some physiologists have supposed that the several humours enumerated above exist distinctly in the blood, and that the different secretory organs are only mere strainers. But this conjecture is not well founded; for bile does not exist in the blood before it is prepared in the liver; and the same remark applies to the other humours. For though the constituent principles of all the secreted humours are to be found in the mass of blood; yet they are variously combined in the glands; and from this diversity of combination they chiefly derive their peculiar qualities.

§. 87. The *qualities* of the body are such circumstances as regard the general form of the

the body, and the distinctive marks of particular constitutions, derived from the frame of the body, the countenance, the aspect of the eyes, the colour of the skin, the texture of the muscles, the state of the pulse, &c. If the physician is not conversant in all these circumstances respecting the body in its healthy state, it will be impossible for him to judge accurately concerning the changes they undergo by the effects of disease. He ought to be an acute physiognomist; that, in the contemplation of the countenance, the index of the mind, he may not only discern the changes in the state of the body, but the operation of the passions, in cases where the patient, from delicacy, or other motives, may be unwilling to reveal the true causes of mental perturbation and distress.

There have been many instances of this kind of medical sagacity, by which the genuine sources of diseases have been discovered and removed; which would otherwise have been inscrutable and fatal; and therefore a profound knowledge of the human heart and character is more essentially necessary to physicians than to any other order of men.

§. 88. *Simple Morbid Affections of the Natural Functions.* In considering these, I shall constantly refer to those sections in the preceding part of the work, which treat of similar affections of the simple fibres, and of the animal and vital functions.

§. 89. The organs adapted to the natural functions being composed of simple fibres, they must necessarily be subject to all their affections, p. 8, §. 4.

§. 90. As the blood circulates thro' them they must partake of its morbid changes, p. 9, §. 6, and those of morbid intestine motion, p. 138, §. 62.

§. 91. As these organs are *peculiarly* endowed with sensibility, they are necessarily liable to all the morbid affections of the nerves, p. 18, §. 10, and to all the effects of sympathy, p. 22, §. 11; and part of their structure being muscular, they will partake of all the morbid affections of muscles, p. 28, §. 13.

I have however some particular remarks to make on nervous and muscular affections,
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in this chapter, which could not be so properly taken notice of before; and which peculiarly belong to this place; the stomach and intestinal canal being the grand seat of such diseases as are commonly called nervous; those especially which go under the denomination of hysterical, hypochondriacal, and melancholic.

It may be proper to remark, as explanatory of the different kinds of morbid sensibility, that there are certain invariable laws in our system by which the effects of stimulus, whether natural or morbid, must constantly be regulated. *1st.* An organ habituated to a weak stimulus, is very much irritated and disturbed by a stronger: thus the eye is exceedingly dazzled by transition from a weak to a strong light; and water drinkers and plain feeders are much disordered by high fauces and strong drink. *2dly.* An organ long used to a strong stimulus will not be properly incited by a weaker; as, being long in a strong light, we cannot see in a weaker; and strong wine will not gratify the stomach of an habitual dram-drinker. *3dly.* When the organ has been long habituated to a strong stimulus, it becomes so torpid, as to

be insensible to their impression: this explains *Buffon's* experiment of red silk on white paper; and why brandy tipplers have had recourse to rectified spirit. *4thly*, When the immediate effect of a strong stimulus ceases, debility, torpor, or both, follow; hence tremor of the hand after a debauch, and palsy after convulsion. *5thly*. The degree of irritation does not always depend so much on the quantity, as on its being adapted to the nature of the organ: thus we can excite vomiting by tickling the throat with a feather; though a wound of that organ will have no such effect. These general laws will explain many circumstances respecting the morbid state of the nervous system, and will be occasionally referred to hereafter.

I have remarked, p. 18, §. 9, that excess, defect, or perversion of sensibility, are the only sources of nervous diseases. I shall consider these separately.

1st. It may be excessive, as when the stomach and bowels, which are very irritable organs, are disturbed by very slight causes: Thus I have seen an hysterical woman excessively vomited by a single grain of ipecacuanha, and an hypochondriacal man very much purged,

purged, and extremely sunk, by an exceeding small dose of rhubarb and magnesia:—a caution, by the bye, against the repeated use of even gentle purgatives, of which such patients are very fond.

The upper orifice of the stomach, being exquisitely sensible, if it be rendered more so by disease, becomes the chief seat of those most distressing sensations of constriction, spasm or cramp, heartburn, anxiety, sinking, sickness, and a kind of convulsive commotion to which hysterical and hypochondriacal patients are subject; beside many ungrateful feelings in the whole tract of the intestinal canal, though not in so exquisite a degree.

These symptoms however may be partly produced by excess or deficiency of *tension* already explained p. 133, when the whole tract of the canal, or any portion of it, is either too much stretched by its natural stimuli, or not sufficiently so. Thus, before a nervous woman falls into an hysterical fit, she generally has the sensation of a ball ascending through the stomach into the throat, which seems to be owing to flatus or vapour ascending the cavities, and confined by a spasmodic stricture: the uneasy sensation is

extended, by sympathy, to the heart, brain, and spinal marrow, the whole system is thrown into the utmost confusion, and the palpitative convulsion of the heart is propagated to almost every muscle of the body, voluntary and involuntary: after repeated convulsive struggles, the patient falls into a stupid state, and awaking from thence finds herself fatigued, languid, and depressed.

Here we have, in quick succession, three different morbid changes of the nervous system; from excessive irritation to paralytic insensibility, and from that to extreme weakness; and during these changes there is not a function, an organ, or even a single sensible fibre, that is not more or less disturbed.

Some very irritable men undergo similar sensations and sufferings, though in a less degree; and from this explanation of the phenomena of irritability, we see that there is but a very thin partition between excess and defect of sensibility, and can account why exquisite sensibility sometimes terminates in paralytic weakness; and irritable hypochondriacs may fall into melancholic insensibility.

2dly. *Sensibility* may be said to be depraved, when there is not a due correspondence between

tween the sensation excited in the nerve, and the idea excited in the mind. The difference therefore between this and the former is, that in simple excess of sensibility, the idea is exactly correspondent to the sensation; that is, great pain, sickness, or any other uneasy sensation, produces a similar impression on the soul; whereas, in this, the idea is often incorrect or false; as in a hypochondriacal or melancholic person; instances of which are given §. 10, and more will be given hereafter.

Depraved sensibility is generally connected with excess of it, though there are exceptions. It appears more frequently in the organs of digestion than in any other part of the body: hence the stomach is often offended by many things which do not always disagree *even* with irritable stomachs, as honey, rhubarb, wine, &c. Such persons often have an aversion to such articles of food, drink, or medicine, as were formerly agreeable: hence also the longings of pregnant women, disagreeable sensations in the stomach allayed by uncommon foods, or by lime, chalk, coals, &c. and timidity and apprehension of danger from causes which cannot hurt them, arise from depraved sensibility.

Hypochon-

Hypochondriacism, both in males and females, seems to depend on excessive and depraved sensibility combined in various degrees, and hence the great variety, mutability, and strange peculiarity of their feelings, which powerfully disturb and derange every faculty of the mind.

When these nervous affections become inveterate, they are often followed by effects to be taken notice of under the next head.

But before I proceed, I shall make a remark which will tend to explain some circumstances of depraved sensibility. I have remarked before, that a fine vapour exhales into the intestinal canal, as well as into every other cavity. Should the discharge of insensible perspiration from the skin be checked at any time, it is more readily determined on the cavities of the stomach and bowels, than on any other part of the body. Hence we are able to account for several of the disagreeable feelings of hypochondriacal patients: such persons are peculiarly subject to a kind of acrimony or sharpness of humours which is generated in the excretory organs, and has by some authors been distinguished by the name of land-scurvy, to distinguish

distinguish it from sea-scurvy. As the perspiration is in such patients very irregular, and easily checked, if it is diverted on the bowels, in the form of vapour, and if it does not, as some suppose, form a considerable part of the flatulence of which such patients complain, it certainly irritates the nerves of those organs, and excites various uneasy feelings, and spasmodic constrictions of different portions of the canal. In confirmation of this, I shall mention two cases which led me to adopt this opinion. A very studious clergyman became exceedingly hypochondriacal; but was suddenly relieved from his paroxysms of this kind, by an angry pimple behind his left ear; and this repeatedly. An hypochondriacal and gouty patient, who had missed his usual fit of the gout, fell into a melancholy, but after some time had an eruption of a scurfy kind on one of his hands, and some little boils on his head, and in a few hours after this appearance, recovered his spirits, and became alert and cheerful. We know that gouty persons can often predict an approaching fit by uneasy sensations and flatulence in the stomach and bowels. In the two cases now mentioned,

tioned, and several more which have since occurred to me, the relief obtained was probably not so much the effect of a trivial eruption, as that it shewed the acrid perspirable matter was again determined to the skin; some of which, hesitating in the small vessels and glands, produced the eruption, as in the gouty subject it fell on the joints: gout therefore does not seem to be so much an exquisitely nervous disease, as some have supposed, but rather an effect of a peculiar acrimony. Hence we can account why some women, having been nervous in the earlier part of life, have become hypochondriacal at or about their 50th year, and have at the same time irregular gout, which rarely, however, terminates in a compleat fit; owing probably to the constitution not being able to determine the acrid matter to the joints in any permanent degree. Hence we can account for the great temporary and sometimes permanent relief which hypochondriacal and gouty patients experience from drinking the Bath waters, and using them as a bath, beyond any other remedy hitherto discovered; and this relief is obtained partly from their stimulating and invigorating quality, partly from

from their restoring the perspiration, and giving to the acrid matter a habit of afflux to its natural outlet, the perspiratory vessels of the skin.

In my occasional visits to the Bath Hospital I have always found a very considerable number of the patients with an eruption upon the body, which the common people call a surfeit, owing, they say, to heats and colds; and Dr. *Falconer*, one of the physicians to that excellent charity, informs me, that the proportion of such patients is very considerable, and that they are almost always cured by a course of bathing. These people are generally labourers, and exposed to inclemencies of the weather, and obstructed perspiration whilst hot; and this eruption often succeeds an imprudent use of cold drinks. It seems to be a species of the land scurvy, as is the leprosy in its various degrees, though it is now very rare in these temperate climates.

3^{dly}. Deficient sensibility is of various degrees: When persons are habituated to the use of high-seasoned meats, or strong drinks, the stomach cannot bear or digest such as are insipid; and persons who use purges frequently, are obliged to increase the dose, or
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have recourse to stronger. In these instances the fault is rather in the defect of stimulus than of sensibility; but it suggests a most important caution, *i. e.* that persons in health, the young especially, ought not to habituate themselves to stimulating foods and drinks, otherwise they create a necessity of gradually increasing the degree of their stimulus, until they arrive at the highest possible: and hence it is that epicures and bon vivants totally destroy the sensibility of the stomach, and degenerate into dram-drinkers; because nothing less stimulating will gratify the enervated organ;—a dreadful state! by which the lives of thousands have been embittered and shortened. These and other causes may render the nerves of the stomach and bowels less or more callous and insensible; and no cause concurs more frequently in producing this effect, than severe and inveterate nervous affections of those organs, which, from extreme irritability, gradually degenerate into a state of palsy; and schirrous obstructions of the liver, mesenteric glands, and coats of the stomach and bowels, precede that diseased state of the brain mentioned page 84, §. 39.

§. 92. The

§. 92. The organs which minister to the natural functions must be subject to all the evils enumerated §. 61, 62; to all the effects of suddenly diminished and increased determination, §. 63; to the effects of general fever, which often exercises much of its violence on the digestive organs, and those of secretion and excretion; and to inflammation, §. 65; and hæmorrhage, §. 66.—Many of these effects are the consequences of suddenly diminished determination in some remote part of the system, and a sudden fluxion of humours on the stomach and bowels, or some other outlet; instances of which I gave §. 63, and shall add a few more. Thus vomiting and purging in the different stages of fevers are effects of this increased determination; instances of it also occur in malignant and putrid fevers, when the absorbed effluvia fall upon the bowels in the form of bloody flux; remittent fevers often terminate fatally in inflammatory congestions of the bowels; and gouty and other acrimonies recede from the joints to the lungs, stomach, and bowels.

§. 93. *Morbid Determination slowly increased or diminished.* When the progressive motion of the blood is carried on rapidly, the changes of
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determination will partake of that rapidity, some of the effects of which I have mentioned above; but when it is slow and weak, the species of determination now taken notice of must take place in some degree.

It is on this principle we may account for many errors of the secretions and excretions.

1st. The secreted humours may, from the habit of fluxion, or determination, to particular organs, increase the discharge; of this we have examples in catarrhal defluxions, profuse sweats, and wasting diarrhœa, in slow fevers, and in other diseases; and as a proof of this being the case, if we check the sweat, the purging increases, and the reverse; and when both are lessened, the breath becomes oppressed, or the spitting more copious.

2^{dly}. If secretion be increased beyond the healthy degree, and the absorption be not in proportion, a variety of evils is produced; thus some kinds of phlegmatic cough, collections of tough phlegm in the stomach, diarrhœa, &c. may be the consequences.

3^{dly}. Another more complicated and dangerous degree of determination is, when it arises from a great impediment to the circulation through some other organs, in which
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the determination being necessarily diminished, a greater determination takes place to those cavities where there is the least resistance; as when a river, being dammed up, overflows its banks. Hence various kinds of dropsy from obstructions of the lungs, liver, mesenteric glands, &c.

4thly. Another fault of determination, by which the secretions and excretions are very much depraved, is, when the absorbents take up only the finer part of the fluids from the cavities, leaving the grosser behind.

From this cause proceeds every kind of tumour or swelling both of the external parts, and internal organs, which are not accompanied with pain; hence œdematous swellings of the legs, swellings of the glands of the breasts, wens, and other insensible tumours on the surface of the body, andricketty and other enlargements of the bones, and from a similar cause, various obstructions of the substance of the heart, lungs, liver, mesenteric glands, &c. of the glands of the throat, and of the coats of the whole intestinal canal, as of the œsophagus, stomach, &c. by which they are thickened, their cavities lessened, and their nerves compressed into a state

state of insensibility. From a similar cause are formed gall-stones, gravel in the kidneys, and puffy swellings and chalk-stones in gouty limbs.

Here I shall take notice of two kinds of slow fever which very often attend the effects of morbid determination, No. 3 and 4; the understanding of which is necessary in a philosophical essay of this kind, and will conduce very much to explain my remarks on dietetic regimen.

In many slow diseases there is a low irregular fever, which generally proceeds from a cause similar in kind but not in degree to that which produces the fevers taken notice of under §. 64; that is, the blood, being denied a free passage through obstructed organs and vessels, excites the heart to more frequent contraction, to overcome the resistance, and thus a slow fever may be produced *even* in adropsy; but as the resistance is formed gradually, and the progressive motion of the blood languid, it seldom rises to any height, so long as the tumours remain indolent.

But various causes may increase the determination upon those organs, distend their vessels, and produce various degrees of inflammation. This

This state suggests the idea of one kind of *hectic* fever, which continues during the inflammation of the organ; or if matter should be formed, its stimulus supports or renews the inflammation, until the whole fabric of the organ is converted into a mass of matter, and its functions are totally destroyed; as is evident from dissections.

If the organ be membranous in its structure, as the air-cells of the lungs, the stomach, intestines, &c. the surface of the membrane being inflamed, is covered with a yellowish glutinous serum, thrown out by the inflamed vessels, similar to that which is thrown off by spitting in inflammatory coughs, and which has been often mistaken by the ignorant for matter, when consumptive patients are said to be spitting up their lungs.

Hence we can account why the hectic fever is more severe, as the stimulus is greater; and sometimes very slow, or rapid in its progress.

The vulgar have no idea but of one kind of consumption, viz. that of the lungs; whereas there are as many kinds of it as there are organs susceptible of obstruction and inflammation. We can easily account, from what

has

has been said, why the low fever often becomes hectic.

What I have now said concerning fevers, compleats the theory of that important class of diseases, so far as is necessary to gratify philosophical curiosity: though certainly not sufficiently explicit for practical purposes.

5thly. We may also refer to morbid determination an enlargement of some organs, as if by an addition of their fleshy substance: this has happened to the heart, liver, and some others; and under this head we may bring polypus of the nose, &c. which is a fleshy excrescence, and the fungus vulgarly called proud flesh on the surface of ulcers, and even of bones when ulcerated. In all these cases it should seem that there is a real extension of the substance, and of the vessels that nourish them.

Something similar to this is that swelling of veins called *piles*, which often burst and discharge blood; and the formation of little bladders called hydatides, which adhere to the surface of the liver, intestines, &c. in dropries, and have been found also floating in the cavities; they are supposed to be
enlarged

enlarged lymphatic vessels, but their real nature is not yet well ascertained.

There is another fault of determination; when in consequence of some previous inflammation, the serum or coagulable lymph ouzes through the ends of the vessels, and, as it were, glues the contiguous organs to each other; as the lungs to the pleura, the heart to its covering, and the intestines to each other.

To avoid many subdivisions, I shall just take notice, that bile is sometimes determined to the skin, and produces jaundice; and that various discolourations of the skin, either from the birth, and called marks, or from disease, are effects of irregular determination.

6thly. Another species of morbid determination, and a very frequent and important one, is when our nourishment misses, as it were, its natural course, and, in various fevers, is hurried off by morbid determination through one or more of the excretions: this is one cause of the waste of flesh and strength in those diseases. Another kind is when from some obstruction of the mesenteric glands, or lacteals, by which the passage of the chyle to the blood is prevented

it passes off by the intestines: or, having been received into the blood, the particles of nourishment, instead of being retained, and applied to the nutrition of the solids, run off quickly by the bowels, skin, or kidneys, and produce what is called atrophy, or wasting: or, the bony matter, instead of supplying the waste of the bones, may form a part of the substance of muscles or membranes, instances of which we meet with on dissection: or they may receive no due supply; and hence the bones have become quite soft and pliable.

7thly. If there should be any taint, hereditary or acquired, in the secretory and excretory organs; where it is probable such taints lurk, rather than in the whole mass of blood, we can easily conceive how they may, by intestine motion, §. 62, p. 138, or by some other faculty of depravation which cannot be accounted for, assimilate the fluids, with which they mix, to their own nature: hence probably gouty, rheumatic, scrophulous, leprous, scorbutic, cancerous, and other acrimonies, producing correspondent foulness of the glands or skin. This subject has been treated of §. 62, p. 138.

Animalcules,

Animalcules, or their eggs, may lodge sometimes, in a very unaccountable manner, in particular cavities; and hence worms of different kinds in the stomach and bowels; and some of those animals, the like of which are not to be found in nature, lurk in the liver, and other organs; and the *Dracunculus*, or Guinea-Worm, under the skin. The generation of these vermin is commonly owing to some fault of the digestive faculty.

§. 94. I shall close this long chapter with a few remarks on faults of digestion, a very important subject.

1st. As a regular and perfect digestion, in every stage of it, must depend very much on a healthy state of the circulating, secretory, and excretory systems; so, when the progressive motion of the blood is either excessive, as in fevers and other acute diseases, or deficient, as in chronic diseases, the appetite and digestive powers must be impaired in some degree; and therefore there is not a more certain presage of returning health, than an increase of appetite and a good digestion.

2^{dly}. As the good or bad qualities of the humours employed in the office of digestion must depend on the state of the secreting organs,

gans, so, when they are diseased, the saliva, gastric, and intestinal liquors, the bile, &c. may be, from this cause, either too inert and acefcent, or alcalescent, putrid, or tainted with some other acrimony; and consequently the aliment can never be converted into good chyle during this state of depravity. When the digestion is impaired, the acid acrimony is more frequently prevalent than any other; which shews that the acetous or vinegar fermentation often takes place in a weak stomach, from deficient alcalescency of the saliva and gastric lymph. Gout has been supposed to be a disease of indigestion, but it seems to be so rather secondarily than absolutely: depraved digestion seems to be more frequently and intimately connected with hypochondriacism.

3dly. A regular digestion seems to be peculiarly connected with a healthy state of the excretions: hence it is that constipation or diarrhœa, obstructed perspiration, or profuse sweats, are generally accompanied with a morbid state of the digestive faculty. A due preparation of the chyle depends so much on a sound state of the intestines, that, if they are morbidly affected, it must not only be imperfect,

imperfect, but carry that imperfection through every other stage.

If, for instance, the bowels are locked up, and oppressed by their accumulated contents, the due mixture of the aliment with the digestive humours will not only be impeded, but the passage of the chyle through the lacteal absorbents will be retarded. With respect to the connection between digestion and perspiration, it will be explained in the essay on regimen.

4thly. Excessive and depraved sensibility tend very much to weaken the digestive powers, by changing that state of the nerves of the stomach and bowels which disposes them to be gratefully affected by the aliment, and properly excited to promote the peristaltic motion of those organs, and a due secretion of the humours: hence the various distressful feelings of nervous patients about the region of the stomach.

5thly. A torpid or paralytic state of those organs, in various degrees, must be accompanied with a weakness and laxity of their coats: hence it is that drunkards, especially dram-drinkers, lose all sense of hunger; and discharge, almost every morning, great quan-

tities of viscid or ropy phlegm, which is the natural mucus accumulated and perverted.

6thly. The passions of the mind, when excessive, very much injure digestion.

7thly. The effects of excess or deficiency in the quantity, or of the stimulating or other qualities of our foods or drinks, will be considered in another essay.

§. 95. From what has been said concerning the morbid affections of the animal, vital, and natural functions, the morbid state of the qualities §. 86, p. 190, may be easily understood.



CHAP. III.

GENERAL OBSERVATIONS ON THE
HUMAN BODY.

Embriotic state of Animals—of Man—different Stages of his Life—Antediluvians—Post-diluvians—Giants—Dwarfs—Proportion of Deaths at different Periods of Life—of Males and Females born—of Males and Females married—Proportion of the Mortality of different sexes—Diseases of different Countries—Relative Healthiness of different Climates—Countries—Places—Of Temperaments in general—in particular—Diseases of each—Comparative view of Mortality in two different Centuries—Probable Causes of Difference in this respect—Objections to the Suttonian plan of Inoculation.

§. 96. **F**ROM various observations made on animals, especially birds before they are hatched, it appears that all the solids are formed from the fluids, and therefore

fore are different from them only in the degree of consistence. It appears also that as their first rudiments, in the embriotic state, are formed from a part of our humours called the coagulable lymph, which nearly resembles the white of the egg; so it is by this lymph that they are afterwards nourished.

Though it is probable that all the parts of the chick are really existing at its first formation; yet some of them appear sooner than others, especially the heart, large blood-vessels, and the spinal marrow; and the other organs afterwards in a certain succession, until the animal is compleatly formed.

—As nature is simple and uniform in her operations, we may by analogy, suppose that infant man is formed nearly in the same manner.

§. 97. When born, he is the most feeble and helpless of all the animal creation; his solids, even his bones, are soft, the nervous system is very irritable, his heart larger in proportion, and his blood, and all the humours secreted from it, are much more bland and mild than in the more advanced stages of his life; when they become gradually more
sharp,

sharp, pungent, and acrid, in proportion as the solids acquire more strength and firmness, and the nerves become less irritable;—a wise provision of nature to accommodate the natural stimuli to the degree of irritability.

Infant man is the only animal that cannot walk soon after birth: his senses of seeing, hearing, smell, and taste, seem to be less acute for some time after birth: his sense of internal feeling is very acute. He attains a state of maturity, with respect to his corporeal powers, later than any other animal; though it has been doubted whether he is now so long lived as some of the brutes.

Man acquires his speech very slowly; and though his memory is strongest in youth, yet many years elapse before his reasoning faculties are matured, even by the most careful cultivation, without which he would remain in a state of mental weakness almost equal to that of brutes; as is evident from the state of *Madame Le Blanc*, the Polish Boy, and others, which had, by accident, associated with other animals only from an early period of life. It appears, however, that what we acquire in our mental powers by culture and social intercourse with our own species, we lose

lose in bodily strength, agility, and instinct; those wild people being found to excel very much in those qualities.

§. 98. There are certain stages or periods in human life, when considerable changes take place.

The first period is that of dentition, or cutting the teeth, which begins generally about the sixth month, and the first set is generally formed about the third year. This set is succeeded by another between the ninth and thirteenth years, and about twenty-one we cut the remainder. In some cases the teeth have been renewed thrice, or even four times; and sometimes very old persons have renewed their teeth.

The growth of man is compleated about his twenty-fifth year, and remains nearly stationary to his fiftieth year, when his bodily and mental powers, his judgment excepted, gradually decline; his nerves become less irritable, his fibres more rigid; many of his small vessels cease to be pervious, and become solid chords; his digestive organs and powers decline; the functions of assimilation and nutrition are more tardily performed; his
vital

mental powers and circulation become more languid; and he gradually sinks into the "slipper'd Pantaloon, sans eyes, sans teeth, sans sense, sans every thing," except something like a vegetable existence.

Some ill-founded stories have been told of something like a renovation of youth. The great *Lord Verulam* imagined that some medicines might have that effect; and the celebrated charlatan *Paracelsus* boasted he was possessed of such a remedy for old age, yet died a young man: but there are not any well-authenticated accounts of this retrograde motion of human life. It is certain, however, that as premature old age is often brought on by various irregularities; so its progress may be retarded by a total abstinence from strong drinks, and a spare diet, chiefly of milk and vegetables, and removal into a warmer climate.

Man is longer lived than almost any other animal. The extreme age of the Antediluvians can only be accounted for, on physiological principles, by supposing that the earth, its atmosphere, and productions, must have been different then from what they are at present.

Of

Of the Postdiluvians, notwithstanding some fabulous accounts of extreme longevity, it is probable, that *Parr* who died at 152, and *Jenkins* at 169, both Englishmen, were not exceeded by any in respect to long life; and yet *Parr* did not seem to have died from a natural decay, but in consequence of a change of living from a sparing to a full diet. It is not easy to estimate the age of man at a medium, for reasons to be assigned hereafter.

From bills of mortality it appears that not more than two or three in 1000 attain the 100th year, and only one in 5000 exceed that age.

There is a considerable diversity in the growth and stature of man. In some instances the growth has been enormous: a boy of twelve months old was four feet and a half high; another of four years had the voice, stature, strength, and beard of a man. Similar instances have occurred in females. On the other hand, some dwarfs, at their full growth, have been from three feet to sixteen inches in height. Some persons have decreased in size and growth; a child which weighed twelve pounds at the birth, weighed little more than nine pounds at five years old.

old. Persons as they advance to old age, generally decline both in weight and stature.

Unless we account the Patagonians to be a race of giants, there is no other nation hitherto discovered that can be deemed such, though individuals of almost every country have equalled, and even exceeded them in stature.

Without controverting the truth of stories of the immense size of human bones, and even of human skeletons, many persons have been known to measure from six feet and a half to seven feet and a half; a Swede in the service of *William Frederick King of Prussia* measured eight feet and a half, and *Goliath* is supposed to have measured nine feet.

From what we have seen of man in his progress from his embriotic state to his final dissolution, it appears that the period of his corporeal existence is very limited; and it may easily be conceived how much it is so, from the following calculation:—

Of 1000 persons, 23 die in the birth, 277 from teething, convulsions, and worms, 80 from small-pox, 7 in the measles, 8 women in child-bed, 191 of consumption, asthma, and other diseases of the breast, 150 of fevers,

12 of

12 of apoplexy and lethargy, and 41 of dropsy, omitting other diseases not so well ascertained; so that only 78 of 1000 attain what may be deemed old age.

Or, if we take it in another point of view: Of 1000 persons, 260 die within the first year, 80 in the second, 40 in the third, and 24 in the fourth; and within the first eight years of life, 446, or almost one half of the number, are cut off by premature death.

It may not only be a matter of curiosity, but of real utility, to enquire into the causes of these events.

§. 99. The chief cause is the structure of our body, composed of manifold organs whose movements are exceedingly complicated, and between which an exact correspondence and harmony is indispensibly necessary for the preservation of health.

This correspondence consists

1st. In a free intercourse of the brain and spinal marrow, through the nerves, with all the organs of sense and motion.

2^{dly}. In a ready and uninterrupted communication, between the heart and every organ of the body, by means of the circulation.

3^{dly}. In

3dly. In a due proportion between the organs and their natural stimuli; insomuch that they may be excited thereby to perform their several functions or motions with ease, vigour, and constancy.

4thly. In a due discharge, by the various excretions, of all the superfluous, useless, or noxious particles of our solids and fluids.

5thly. In such a state of the digestive organs, and those appropriated to secretion and nutrition, that they shall prepare and dispense nourishment sufficient, and of such quality, as may supply the daily waste.

6thly. That such a regimen, with respect to diet and various other circumstances, be established, as may contribute to effect all the purposes enumerated No. 1—5.

Besides those circumstances of the general frame and nature of the human body which constitute a healthy state of the organs and their functions, each person has a particular species and degree of health, resulting from certain peculiarities of his constitution; and therefore the doctrine of temperaments is a branch of physiology.

The antient physicians paid more attention to this subject than the moderns; but they

they mistook the true principles of temperament, supposing them to depend on the state of the humours; whereas the state of the solids, especially of the nervous system, is certainly the foundation of this distinction. Some of the most celebrated modern physicians, as *Baerhaave*, *Hoffman*, *Haller*, and *Huxham*, have not neglected the doctrine of temperaments.

The most careless observer must have remarked, that there is a manifest difference between the constitution of a strong man, and that of a delicate woman; and between that of a person of a florid complexion, and another of a pale, fallow aspect; and as physicians are very rarely consulted concerning the means of preserving health, it is evident, that every person who justly estimates this blessing, ought to study his own constitution, and be acquainted with the distinctive signs of his temperament: for it is manifest, that the same regimen cannot be suited to different constitutions, any more than that the same remedies can be effectual in curing their diseases.

§. 100. The *firm* temperament, or habit, is distinguished by large prominent muscles,
firm

firm flesh, and a robust frame. In such persons the pulse is strong and slow, which shews that the vital powers are strong, the blood rich and dense, the circulation vigorous, the secretions and excretions highly assimilated and alcalescent, and the nervous system firm, steady, and not too irritable. Persons of this habit have a strong disposition to high fevers and inflammatory diseases.

§. 101. The *delicate* temperament is marked by a slender frame, softness of the skin, and a susceptibility of strong impressions from slight causes. This temperament is, in every respect, opposite to the former, especially with regard to the irritability of the nerves; and persons of this habit are most disposed to fall into nervous diseases and low fevers, accompanied with manifold nervous symptoms. This peculiar tendency to acute feelings does not seem to proceed from a larger portion of nervous substance, but is probably owing to the slenderness of the fleshy fibres, and of the cellular texture; and hence the nerves are not so much defended from impressions as in the firm habit, where the fibres are more gross and tense; or

Q in

in the lax habit, wherein the cellular membrane is more lax, gross, and copious.

§. 102. The *sanguine* habit is known by a florid complexion. This florid, ruddy appearance is generally confined to the earlier part of life, and rarely extends beyond the middle age; it shews that the vessels are too full of blood. The pulse is full and soft. Persons of other temperaments are apt to be sanguine at particular times of life. In early life the fulness is chiefly in the arterial system; in advanced life, in the veins. Such persons are subject to fevers, and large discharges of blood; their fevers, at first inflammatory, are often putrid in the advanced stages.

§. 103. The *lax* or *phlegmatic* temperament is distinguished by the flesh being loose and spongy, and the complexion pale and fallow. In this habit the pulse is weak and soft, and appears to be more so, as the cellular membrane is thick and loose. This habit is also in several respects opposite to the firm; the vital powers are weak and languid, the circulation tardy, the texture of
the

the blood loose and watery, and the humours not sufficiently alcalescent. In some persons of this habit, the nerves are too irritable; but this is rather the effect of indolence, luxurious indulgence, or disease, than of the natural temperament. Asthma, dropsy, palsy, profuse discharges by the bowels and kidneys, and various maladies of the slow kind, are the diseases of this temperament: when they are seized with fever, it is either very tedious, and in general attended with a considerable degree of insensibility, or with obstinate agues.

§. 104. The *dry* habit is known by the frame of the body being lean and spare, and the complexion of a dark brown. This habit was termed by the ancients the melancholic or atrabilious temperament. It sometimes continues from infancy to the end of life. The pulse is generally hard and slow; the secretions commonly highly alcalescent.—Diseases of the skin, as scurvy, commonly so called, and St. Anthony's fire, and melancholy, or hypochondriacism, are the most frequent complaints of this temperament.

I was in some doubt whether I should take any notice of those temperamental propensities to particular diseases, lest I might impress the minds of individuals with unnecessary apprehensions; but there is no constitutional propensity which may not be counteracted by due care and caution; and the means of preventing those diseases will be taken notice of in the Essay on Regimen.

From what has been said, it may be inferred, that the difference of temperament depends on the degree of firmness of the fibres, strength of the vital powers, irritability of the nerves, and the proportion between the vessels and the fluids they contain.

The ancients supposed that certain dispositions of the mind were connected with the temperaments, and the observation is not without some foundation.

From the preceding remarks, §. 99, &c. it must be evident that the necessary concurrence of so many circumstances must render health very precarious; and therefore we may easily conceive that, beside the constitutional propensity of our bodies to disease, it must be much increased by irregularities and excesses; and that many of those diseases must unavoidably be fatal.

Some diseases are more prevalent in one country than another; in the northern countries, scurvy, and diseases of the breast; in hot seasons and climates, fevers and fluxes; and the plague, in Egypt and Asia Minor.

Sickly years are from 1 in 4 to 1 in 6 or 7 to the healthy. December, January, and April, are, from observation, found to be the most sickly months; and June the most healthy in the year; and January is to June as 11 to 1.

When a particular disease prevails, it is called an epidemic. London, and other large cities, are seldom without small-pox or measles. Once in four or five years an epidemic attacks a place; when it returns less frequently, it is in proportion more fatal. Females suffer more in the beginning of an epidemic; males at the end. If an epidemic sets in smartly, its duration is short, if slowly and by starts, it continues longer.

Cities and large towns are much less healthy than villages and solitary houses in the country.

It is not easy to determine, with any precision, what particular climates are most favourable to long life, because there are in-

stances of it in every country; but it should seem that the greatest proportion has been found in *Great-Britain, Ireland, and Italy*.

Dr. *Franklin* asserts that the United States of *America* double their population once in 25 years; but this is certainly over-rated: Dr. *Derham* supposed that *England* would double its inhabitants only in 434 years; but this calculation is below the truth.

The following curious and interesting circumstances cannot be unworthy of the reader's attention.

1st. The proportion of males born to that of females is 14 to 13.

2^{dly}. Of still-born children, 1 to 15; of these 10 male to 7 female.

3^{dly}. One in 33 are twins; 1 in 6500, 3; 1 in 20,000, 4; and 1 in a million, 5 are born at a birth.

4^{thly}. London buries, of children under two years old, 39 in 100; Edinburgh and Northampton, 34; and in the country, from 20 to 28.

5^{thly}. Fewer men are married than women; for 62 boys die to 53 girls; and 12 young men to 11 young women: and of married men to married women: there die $15\frac{1}{2}$ to $10\frac{1}{2}$ per cent.

6thly. Since the Restoration, the proportion of burials to births is considerably increased, from increase of luxury among the wealthy, and tea-drinking and intemperance among the lower rank: hence our offspring being more puiſny, more die in the proportion of 9 to 1 in 35 of convulſions; and ſo of other diſeaſes.

If we take two diſtant octenaries, or periods of 8 years each, the firſt from 1629 to 1637, the ſecond from 1734 to 1742, nearly a century diſtant; the following table will ſhew that the mortality of the latter is greatly increased, and I am perſuaded it is ſtill more ſo within the laſt 40 years.

1ſt Octenary, 1629 to 1637.

A. Died within the month	—	6 in 15
B. Of cutting teeth	—	1 in $8\frac{1}{2}$
C. Of Conſumptions	—	1 in $3\frac{1}{2}$
D. Fevers of various kinds	—	1 in 49
E. Inflammation of the lungs	—	1 in 440
F. Apoplexy and ſudden death	—	1 in 46
G. Dropſy	—	1 in 21
H. Palfy	—	1 in 307
I. Rickets	—	1 in 32
K. Agues	—	1 in 40
L. Small-pox and meaſles	—	1 in 9
M. Child-bed	—	5 in 51
N. Jaundice	—	1 in 98
O. Aſthma		

O. Asthma	—	—	1 in	99
P. Colic	—	—	1 in	196
Q. Worms	—	—	1 in	439
R. Dysentery	—	—	1 in	91

2d Octenary, from 1734 to 1742.

A. Died within the month, above	61 in	94
B. Of cutting teeth	1 in	$4\frac{1}{2}$
C. Consumptions; those who die after 15 nearly the same		
D. Fevers of various kinds	1 in	$3\frac{1}{2}$
E. Inflammation of the lungs	1 in	205
F. Apoplexy and sudden death	1 in	13
G. Dropfy	1 in	14
H. Palsy	1 in	278
I. Rickets	1 in	3000
K. Ague	1 in	1100
L. Small-pox and Measles	4 in	21
M. Child-bed	1 in	11
N. Jaundice	1 in	78
O. Asthma	1 in	19
P. Colic	1 in	39
Q. Worms	1 in	2225
R. Dysentery	1 in	963

I shall now offer a few remarks on the foregoing table.

1st. The increased proportion of infants who die is truly alarming, owing partly to more infants being sent to nurse, and the causes mentioned No. 6 above.

2dly. The proportion of those who died in the 2d octenary of acute diseases, enumerated

rated under B, C, D, E, F, L, of the table is much greater than in the 1st, owing probably to the causes assigned: of dysentery, the proportion is much decreased, because the disease is very much so in civil life, it being now chiefly a camp epidemic: the more liberal use of vegetables in general may be one cause of its decline.

3dly. The proportion of those who die of dropfy and palsy is considerably increased. These two diseases may with much greater propriety be deemed the representatives of all chronic or slow diseases, than gout, as Dr. *Cadogan* alledges; because they are the effects of constitutional weakness, produced often by tedious diseases, and generally close the scene of life. I am clearly of opinion that the increase of those diseases is owing to the general use of tea, especially among the lower ranks, and the increased price of provisions beyond that of labour; and therefore the poor do not live so well as they did a century ago.

The use of the bark has diminished the number of deaths from agues: Worms, or what diseases were attributed to them, make much less havock than formerly; but I have
always

always been of opinion, that they are much seldomer the cause than has been usually supposed; and we now find that the internal dropfy of the head, the early symptoms of which were formerly mistaken for those of worms, is more frequent than was formerly suspected. Rickets have almost entirely disappeared; I believe the disease was not known here before 1540. But Scrophula has increased very much of late years, for very obvious reasons. Fewer women die now in childbed than formerly; and I am persuaded the number is considerably decreased since 1742, because the method of managing these worthy and most useful members of society is much better understood; and they are less frequently destroyed by hot rooms and heating drinks; and notwithstanding the illiberal and absurd reflections made against the frequent employment of men-midwives, they have, I am firmly persuaded, saved many thousands both of infants and mothers, not only by their superior skill in treating their diseases, but by inculcating a more safe and rational management of them.

In almost every other respect, however, the balance is very much against the present age;

age; and as an additional proof, it may be observed, that whereas 140 years ago only 36 children in 100 died under 6 years old; so lately as the year 1740, 45 3-5ths died under 5 years of age.

I shall close this chapter with some observations on small-pox and measles.

Though the measles are perhaps more epidemic this century than the last, yet they are, I believe, less fatal in their consequences, not only because the treatment is better understood, but the repellent plan has not been carried so far with respect to them, as that lately adopted with respect to the inoculated small-pox; though the indications for the management of both diseases ought in general to be nearly the same.

With respect to the small-pox, there is reason to believe that it was more fatal forty years ago than in the preceding century. Even in 1742 inoculation was much less frequent than within the last twenty years, and a greater proportion of the inoculated died of the immediate effects of the disease than at present. But, with all the *apparent* advantages of the *Suttonian* plan of inoculation and preparation, I am convinced, from
painful

painful experience, that more persons have died of diseases consequent of inoculation on that plan, than from the more moderate method adopted by the profession several years before the *Suttons* began to inoculate.

When this plan was first introduced, (and especially as modified by Baron *Dimsdale*, to whose skill and liberality the public is much indebted, whilst the *Suttons* selfishly made a nostrum of their practice) I readily adopted the method in the few cases in which I was consulted as a physician, considering it as a very valuable extension of Dr. *Sydenham's* plan; but I was soon induced to change my opinion.

In 1766, when I resided at *Andover*, several of *Sutton's* pupils inoculated in that neighbourhood. Soon after several patients, chiefly women, applied to me.

Their complaints seemed in general to be complicated with hysterical or hypochondriacal symptoms, a few were dropical and consumptive. Of more than 20 of these patients, several died; and in all I could trace their complaints up to the *Suttonian* inoculation. In 1780 I transmitted my observations on that subject to my ingenious friend

Dr.

Dr. *Duncan*, who published them in the 8th volume of his *Medical Commentaries*, to which I refer the reader; and shall just observe, that Baron *Dimisdale*, in his diary of the inoculation of the *Great Duke of Russia*, seems to have abated considerably of the cooling and repellent regimen.

The small-pox is a disease, in which the constitution relieves itself by producing an eruption of pustules on the surface. It never happens, I believe, under inoculation, that the quantum of eruption is such as either to endanger life, or spoil the complexion, unless the management has been very absurd. The danger of the *Suttonian* practice arises from lowering the patient too much, so that the vital powers are not able to throw sufficient matter on the surface; to which I will add, that exposure to extreme cold has a manifest tendency to prevent a due eruption, and even repel some of the matter already discharged upon the surface; in consequence of which many diseases, as I have already said, were certainly produced: whereas, if the patients had neither been prepared at all, much reduced in their regimen, or very unnecessarily exposed to the cold,

cold, they would have had the disease in a sufficiently mild degree, though all the morbid matter were thrown on the surface, and their future health secured, so far as it could depend on this circumstance.

This opinion is confirmed not only by Sir *William Watson's* experiments at the Foundling hospital, but by the successful practice of the late Mr. *Clarke* at Castle-Cary, who, instead of purging, gave his patients a gently sweating medicine every night, till the eruption was compleated; so that the mode of determining the humours to the skin, more congenial to the nature of the disease, seems to have been fully as successful with respect to the immediate issue, and I believe much safer with regard to future health.

On a perusal of the foregoing pages in MS. Dr. *Falconer* assured me, that the late Dr. *Dealtry*, of York, had declared to him a resolution of publishing a number of cases in proof of the injurious effects of the *Suttonian* method under inoculation, but was prevented by death.

E S S A Y II.

On the Difficulties of attaining Medical Knowledge; those Branches especially which relate to the Practice.

C H A P. I.

Difficulties arising from the extent of Knowledge preliminary to the Study of Medicine—Motives for publishing this Essay—Quackery countenanced from an opinion of the simplicity of the Medical Art—no Art more complicated—demonstrated from the Education necessary for a Physician—His preliminary Education learned and extensive—his medical Education comprehending various branches of Knowledge—Natural Qualifications of a Physician—his moral Qualities—his professional Duties—Animadversions on a Bath Nostrum—Vindication of the practical Skill of young Physicians.

IT seems to be impossible to account for the general countenance and encouragement given to quacks and their nostrums
in

in this kingdom, any otherwise than by supposing that it proceeds from a prevalent and very ill-founded opinion of the medical art being so simple and easily attained, that neither learning, nor even a moderate share of sagacity, are necessary qualifications for the practice of physic.

To combat, and, if possible, totally remove, this dangerous impression, I published MEDICAL CAUTIONS; but conceiving that so important a subject merited a more ample discussion, I have given in the first Essay a sketch of the natural history of man;* and that nothing in my power might be wanting to the completion of so beneficial a purpose, I have subjoined this Essay, which, I flatter myself, will carry to the mind of every reader an irresistible conviction of a most important truth, on which the healths and lives of thousands may depend; viz. That *medicine* is a very extensive and complicated science, and consequently that none but those who have dedicated many years to the study of it as a science, are in any degree competent to the practice of it as an art.

* I always mean this when I refer to Essay I.

The first consideration is the extensive knowledge preliminary to the study of the art itself.

As many valuable books have been written in the dead languages, not only on general subjects of science, but particularly those of medicine, a compleat knowledge of *Greek* and *Latin* becomes a necessary part of medical education; and for the same reason, a knowledge of some of the modern languages would not be improper; that of the *French* is essentially necessary.

Though *Geometrical* principles have not always been happily employed in medical investigations; yet this noble science is so necessary in conducting the mind to the accurate investigation of truth, and the detection of error, that none of the other sciences can be attained with any degree of precision without its aid.

Logic, or the art of reasoning with method and accuracy, is perhaps more necessary to the physician than to any other man of science, as he is chiefly guided by the rules of analysis and analogy in his reasoning on the manifold objects of medical enquiry.

Natural and Experimental Philosophy are indispensibly necessary, as preliminary branches of medical education; because there is scarcely any circumstance respecting the nature of the human body and its functions, whether in a sound or diseased state, which can be clearly understood, without a previous knowledge of the laws of motion, gravitation, and attraction, and of the principles of optics, acoustics, pneumatics, hydrostatics, hydraulics, and mechanics.

That part of *Natural Philosophy*, which regards the phœnomena and various changes of our atmosphere and its meteors, is an indispensibly necessary branch of medical study; because they are not only conducive to the support of life, and the preservation of health, but often become occasional causes of diseases and death.

A knowledge of *Natural History* in all its branches is peculiarly connected with medicine, for reasons too obvious to be enumerated; insomuch that *Botany*, which is one of its principal branches, is considered as a portion of medical science, and *Anatomy* and *Physiology* are also branches of natural history, though more immediately belonging to medicine.

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These are only preliminary branches of education, and we may add, that there is no accomplishment necessary for constituting the character of a gentleman, which a physician ought not to possess in an eminent degree.

Those branches of knowledge which are the immediate objects of medical study are numerous and important.

Anatomy and Physiology, as must be manifest to those who have read Essay I. are the very foundations of medical knowledge; for the same reason that it would be impossible to rectify the faults of a watch, without previously understanding its anatomical structure, and the uses of its various parts, separately, and in connection with each other.

Pathology is that branch of medicine which treats of the nature, causes, and signs of those simple affections, which constitute compound diseases, in a manner which will be explained hereafter. From the explanatory example of the watch, the connexion between this branch and the two preceding must be evident; for though they are curious and valuable objects of philosophical contemplation, of which no person of liberal education

ought to be ignorant, it is the duty of the physician *only* to apply them to practical use in the cure of diseases.

Nosology treats of the nature, cause, and symptoms of compound diseases, and the method of arranging them into classes, orders, &c. according to their characteristical distinctions.

The knowledge of these branches only is merely an object of philosophical curiosity, unless the following are also well understood; as they comprehend the means of preventing and curing diseases.

Materia Medica, as the term imports, comprizes whatsoever regards the distinctive marks, and the nature and qualities, of all the animal, vegetable, mineral, and metallic substances, which are employed in the cure of diseases.

Regimen comprehends every circumstance respecting diet, exercise, &c. which are called the *non-naturals*, and are essentially necessary to the preservation of health, and the cure of diseases; and of this I have treated fully in the Essay on Regimen.

Chemistry is the art of resolving the various subjects of the *Materia Medica* into their constituent

constituent principles, and of separating the most active for medical purposes. But if we consider this art in a more extensive point of view, it forms a very essential part of experimental philosophy, and contributes very much to the improvement of arts and agriculture.

Pharmacy, which is intimately connected with chemistry, is the art of preparing and compounding the various articles of the *Materia Medica*, so as to increase their power and efficacy.

Dosology treats of the doses of remedies, accommodated to different ages and constitutions.

There is so intimate a relation between external and internal diseases, their nature and causes, that the physician ought to be well acquainted with the principles of *Surgery*.

He ought, moreover, to be well informed concerning the history of his art in all its branches, the progressive steps of its improvement, the literary character of the authors who have written on each, and in what respect, and by what discoveries, they have contributed to the advancement of the art.

Having studied the several branches enumerated above, not only under the direction of able professors in each department, but by an attentive and laborious perusal of a multiplicity of books on each subject; he finishes his academical study by an assiduous attendance on the sick in hospitals, under the direction of an eminent physician, whose duty and office it is to explain the nature of each disease, point out the probable changes and event, and assign his reasons for every step he takes for the relief of the patient.

Though thus qualified to enter on the practice of his profession, he cannot be entitled to public confidence, until, by a series of rigid examinations on the different branches of his art, he merits and obtains a Doctor's degree from that university in which he acquired his medical education.

I shall conclude this subject with some remarks on the natural and acquired qualifications, and the duties of a physician.

In his natural endowments, he ought to be a man of genius, quick, penetrating, steady, and intrepid.

In his moral qualities he should be humane and generous, of the nicest honour, and the strictest probity.

In the exercise of his professional talents, he ought to regulate his practice by the principles of a sound and consistent system, of which all the parts have been carefully arranged, the effects foreseen, and all the possible contingencies provided for. His promptitude in prescribing ought to be equal to his patience in deliberation; and having availed himself of every precaution to secure success, he affords himself every possible means of attaining it.

If a new disease occurs, or if those diseases with which he is conversant assume an extraordinary aspect, he will evince the advantages of a regular education, and of accurate analogical reasoning, by quickly discerning the necessity of departing from the ordinary routine of practice, and of adopting expedients suited to the novelty or urgency of the case.

It is the duty of a physician to use his utmost endeavours to relieve his patient as soon as possible; and to reject no means for that purpose, from what quarter soever they may be suggested;—to preserve inviolable his patient's secrets, not only those which respect his bodily infirmities, but every circumstance
which

which may fall under his cognizance, and which it would be improper to divulge.

It is equally inconsistent with the duty and dignity of the physician to pretend to the possession of nostrums, or to *consult with* any person who does; because, in either case, he puts himself upon a level with those empirical wretches, who are the bane of society, and a disgrace to our legislature and police.

And, finally, a physician who is duly impressed with a sense of the utility and importance of his office, cannot fail to discharge his duty with assiduity, humanity and liberality.

I take this opportunity, and I deem it an act of justice, to obviate an objection made to the employment of *young* physicians, that they want experience; and as I am not in that predicament, my opinion will, I hope, have more weight. I have supposed that an attendance on hospitals and clinical lectures is an essential part of a physician's education; and do aver, without the hazard of being contradicted, that one year's experience thus obtained, under the guidance of rational principles, is infinitely preferable to what can be acquired by the routine practice of a century;

century; as will be evident to every person who has perused the preceding essay, and will read the following pages of this, with any degree of attention. And this must unavoidably be the case, not only in the other learned professions, but in every art which is connected with scientific principles.

It is this scientific knowledge which distinguishes the learned divine from the illiterate ranter; the profound lawyer from the pettifogging attorney; the elegant poet from the St. Giles's ballad-maker; and the architect from the bricklayer and common carpenter.

Since my Essay on *Quackery* has been printed off, I have had an opportunity of examining a *Nostrum* sold by an Apothecary of this place, and which, it is rumoured, some physicians here have recommended.—But, I am persuaded, rumour lies; not only because it is derogating from the dignity of the profession, and inconsistent with the duty of a physician, to countenance empiricism; but because any man with a very moderate portion of chemical knowledge, and at the expence of 3s. 6d. may determine
that

that the medicine which the vender has dignified with the title of *Æthereal Spirit*, is nothing more than dulcified spirit of vitriol disguised with a little cochineal.

I shall, in the first place, enquire into the justice of Mr. T.'s claim to the credit of improving *Hoffman's* anodyne mineral liquor, (for he does not deny that it is the same medicine, only that it is improved) and shall next give a short history of this vitriolic preparation; and prove, irrefragably, that his pretension to improvement is fallacious.

Mr. T. alledges, 1st. That his medicine undergoes seven distillations. 2^{dly}. That it has succeeded in cases where *Hoffman's* Anodyne failed. 3^{dly}. That he prepares two sorts of this æthereal spirit; a weaker, which he vends abroad; a stronger, which he reserves for his own practice.

I shall consider each of these in order:—
1st. The distillation is sometimes necessary a second time, when a sulphureous smell of the spirit shews that a part of the unsaturated mineral acid has come over, either by the carelessness or the avarice of the chemist; but if Mr. T. distils his spirit seven times, it is a proof that he is a very unskilful chemist;
for

for if none of the mineral acid comes over, even a second distillation is totally unnecessary; and were he to distil it seventy and seven times, he could not make it more perfect; and must sustain a considerable loss by its exhalation. But there is not, in truth, any necessity for distillation at all; for it may be prepared extemporaneously, according to the judicious direction of the last Edinburgh Dispensatory.

2dly. He asserts that it has succeeded where *Hoffman's* Anodyne has failed. I answer, that the Anodyne liquor must have been unfaithfully prepared; for I am well assured, and can demonstrate, that his medicine is nothing more than *Hoffman's* Anodyne disguised by a colouring matter which cannot add to its efficacy.

3dly. With respect to his alledging that he reserves a stronger preparation for his private practice, there is more of empiricism than candour in the pretence; and the motive is evident. But if his pretence be well founded, why deprive the public at large of the benefit of the most efficacious preparation? As pure æther is the strongest possible preparation, the vitriolic anodyne spirit might be made
more

more powerful, by increasing its proportion to the alcohol; but this will not render it more efficacious than the common preparation, as I shall shew hereafter.

I proceed to give a short history of this remedy.

Every physician who is acquainted with the celebrated Dr. *Hoffman's* voluminous works (and he does not merit the distinction who is not) knows, that his anodyne mineral liquor was composed of rectified spirit of wine combined with the *aromatic*, or, as the Parisian Dispensatory calls it, the *sweet oil* of vitriol, by means of distillation; and that he frequently substituted the dulcified spirit of vitriol in its place, in his prescriptions. The only circumstance that we do not know concerning this remedy is the proportion of the aromatic oil; the Parisian Dispensatory directing only a part to be added, the Wirtemberg College being of opinion that the whole was added by Dr. *Hoffman*: if it was not, his anodyne liquor must have been weaker than the common dulcified spirit. On conversing with the late Dr. *Lewis* of Kingston, a most excellent chemist, on this subject, he remarked, that the proportion of the aromatic
oil

oil was of no consequence, because by increasing the dose of the weakest preparation the same effect would follow; for the proportion of ardent spirit is so small, that its quantity could be no exception to its being given in a pretty considerable dose.

Æther, which is only a concentrated preparation of this remedy, was held for several years as a nostrum, but the preparation is now well known; and the last edition of the *Edinburgh Dispensatory* has given a direction for making it, and has directed the dulcified spirit, or *Hoffman's Anodyne*, to be prepared by mixing one part of the æthereal spirit with two parts of alcohol; a much more judicious method of making it than that directed by the London or Parisian colleges.

After what has been said, it is not likely that Mr. T. is a more adroit chemist than Doctors *Hoffman*, *Lewis*, or *Morris*, (the latter of whom has made some judicious remarks on this subject) or that any man of common sense will suppose that his chemical skill is superiour to that of Doctors *Cullen* and *Black*, the former of whom was long professor, and my preceptor in that branch; and

and the latter now fills the chemical chair in that university.

I have thought it my duty as a physician, and consequently an avowed enemy to all empirical pretensions, to offer my remarks on Mr. T.'s nostrum; not only with a view to place this matter in a proper point of view, but for the information of apothecaries, who are not always *such expert chemists* as their brother T.

I have for many years prescribed *Hoffman's* anodyne, and the dulcified spirit, indiscriminately, not only in dropfies of every kind, but in other diseases; and in gradually increased doses, to more than twice the quantity Mr. T. directs; but as it is sometimes apt, in a large dose, to produce some uneasy sensations in an irritable stomach, I often join a few drops of *Tinctura Thebaica* with it, which

^a I find that Dr. *Falconer*, in his *Treatise on the Bath Waters*, vol. 1st, p. 425, gives the preference to the spirit of nitre, as a diuretic, and on conversing with that Gentleman on the subject, he confirms that preference by subsequent experience.

Dr. *Falconer* gave, at my request, to two persons in the General Hospital 45 drops each of the dulcified spirit of vitriol, which could not be distinguished from *Hoffman's* anodyne liquor either in colour, taste, or smell) twice a day, and to two others 45 drops (which is about 5-6th parts of Mr. T.'s largest dose) twice a day

which increases its antispasmodic, and even its diuretic powers, under certain circumstances.

With respect to the diuretic effects of these dulcified acids, or spirit of nitre, which is of the same tribe,^a they have sometimes succeeded, but have often failed me; and physicians know well, that there is no excretion over which medicine has so little power as that of the kidneys.

They are certainly, however, much more to be depended upon as antispasmodics, and in certain stages and circumstances of fevers, where other anodynes might not be so safe or proper.

day of Mr. T.'s *Æthereal Anodyne Spirit*. None of the above patients laboured under any obstruction of the urinary secretion, therefore there was nothing to impede the efficacy of the remedies, and the season was cool, being in the month of December. After a week's trial, two of the patients, viz. one that had taken the dulcified spirit, and one that had taken the *Æthereal Spirit*, had some increase, though but little, of the urinary discharge, the other two experienced no sensible effect.

Dr. *Falconer* likewise informed me that he had seen another person who had taken Mr. T.'s medicine for some time without any increased secretion by the kidneys, although there was no apparent cause in the health or constitution to prevent its exerting powers of that kind.

To

To conclude; I shall leave it to Mr. T. to determine how far he can reconcile his *pretensions* as a nostrum-monger, to his *credit* as a regular practitioner; especially as his brethren have always been sufficiently loud in their complaints, and with justice, against empirical encroachment and imposture.



CHAP. II.

DIFFICULTIES RESULTING FROM THE
MULTIPLICITY OF DISEASES.

Vulgar Error concerning the nature of Diseases
—Sketch of Dr. SAUVAGES' plan of arran-
ging Diseases—Number near two thousand—
Diversity of some particular Diseases exem-
plified—Multiplicity of the Causes of Diseases
—Difficulty of connecting Morbid Affections
with compound Diseases exemplified.

IT is a vulgar, but ill-grounded opinion, that of diseases distinguished by the same name, as *rheumatism*, *gout*, *consumption*, &c. there is but one kind or species; whereas they are, in many instances, very numerous: for every circumstance respecting disease, which constitutes an essential difference with regard to its nature, seat, symptoms, or method of cure, affords a just foundation for distinguishing the species, and even varieties of the same genus.

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Thus,

Thus, for example, *rheumatism* is a genus, of which there are several species; though nurses and quacks, ignorant of necessary distinctions, recommend *one* infallible remedy for all, how different soever in their nature.

After many imperfect plans were formed for the arrangement of diseases, the defects of which were discerned, but not corrected, by the celebrated *Sydenham* and *Boerhaave*; the late Dr. *De Sauvages* of *Montpelier*, after consulting a multiplicity of volumes, and employing many years in digesting his plan, published a large work, in which he arranged diseases according to the botanical plan of resemblance; in which he has been followed by *Linnaeus*, Dr. *Cullen*, and others.

Sauvages's work is a valuable and important acquisition, notwithstanding its imperfections and redundancies, which I some years ago attempted to correct by the adoption of a new plan.*

To gratify the curiosity of the reader, I shall subjoin the outlines of Dr. *De Sauvages's* plan.

He divides the diseases of the human body into 10 classes, 43 orders, and 315 genera.

* Commentaries on the Principles and Practice of Physick.

Each genus is again subdivided into a certain number of species and varieties, which, if we include the classes, orders, and genera, makes the whole to amount to nearly 2000.*

He defines each class, order, and genus, by certain characteristical marks or signs, by which they may be distinguished from each other: by this method the memory is greatly assisted, and much confusion and manifold mistakes are, in some degree, obviated.

To each of the classes, orders, genera, and species Dr. *Sauvages* has assigned names, expressive either of their nature or causes; and to an account of each species he has subjoined general methods of cure; and also such peculiarities of treatment, as are adapted to particular circumstances of the kinds and varieties of each disease.

From the multiplicity of diseases, and their species and varieties, the reader may easily conceive, how comprehensive and laborious the study of this branch *alone* must be; and how difficult the practice of an art, the objects of which are so multifarious.

* One great fault of this work is, that the Doctor has confounded simple morbid affections with compound diseases; this error has been, in a great measure, corrected by Dr. *Cullen* in his *Nosology*.

Thus, of the diseases mentioned above, he gives of species and varieties of *rheumatism*, 10; *gout*, 14; and *consumption*, 17; and so of other diseases.

Another source of perplexity to the physician is, the multiplicity of causes which contribute to the production of diseases; and have a manifest tendency to change their nature or their aspect; and necessarily create a difference in the method of cure: I shall enumerate some of these causes.

1st. The nature of the human frame, limited in its duration, and unavoidably tending to dissolution, from the construction of its organs, the delicacy of its fibres, and the extreme minuteness and multiplicity of its vessels and tubes. As a machine, in which myriads of organs are in constant motion; it is not at all surprising that some of them should be disordered, or totally impeded, by excess, defect, or various irregularities of their *natural stimuli*;* but rather matter of admiration that we should be so seldom liable to disease.

* This term is fully explained in Essay I. One of the most common errors in medicine is, to consider simple morbid affections with compound diseases; this error has been, in a great measure, corrected by Dr. Cullen in his *Methodus*.

2^{dly}. Temperament,

2^{dly}. Temperament, or constitution, creates a considerable diversity in the nature and aspect of diseases, as has been remarked in Essay I.

3^{dly}. Different periods of life are not only subject to particular diseases but they have a tendency to change the appearance even of the same disease. The different sexes have their peculiar disorders.

4^{thly}. Independent of all these circumstances, we meet with some peculiarities of constitution, which have a considerable influence on the nature and form of diseases.

5^{thly}. The same observation may be extended to the influence of habit or custom, as connected with our modes of living, and employments; hence it is that artificers, seamen, soldiers, &c. are either subject to peculiar diseases, or the maladies to which they are subject, equally with the rest of mankind, have often something particular in their nature and aspect.

6^{thly}. The simple morbid affections* being very few, compared with the multiplicity of compound diseases, of which they consti-

* I have given a sketch of all the morbid affections in Essay I.

tute a part, is one cause of a considerable perplexity; for as they occur in a variety of diseases, often very different in their natures, it requires the utmost sagacity, skill, and circumspection, to distinguish the disease with which they are *really* connected, from others of which they may also constitute a part. This curious and interesting subject merits an explanation.

Cough is a simple affection produced by some cause irritating one or more of the organs of respiration or breathing; and becomes one of the affections of several compound diseases.

Dr. *Sauvages* has enumerated 19 species of cough, all of which are referable either to distinct causes by which it is produced, or distinct diseases of which it constitutes a part,

Cough may be simply catarrhal, or what is commonly called a *cold*; or inflammatory, and connected with pleurisy, peripneumony, various stages and degrees of consumption, &c.; it may proceed from asthma, various kinds of dyspnæa or shortness of breath, arising from a multiplicity of causes irritating the nerves of the lungs; it may be connected with various species of sore throat,
water

water in the breast, or in the substance of the lungs; it may be purely nervous, or spasmodic; it may proceed from measles, small-pox, and other eruptions; or from rheumatic or gouty matter fallen on the organs of respiration: it may be connected with diseases of contiguous or remote organs, as of the heart, liver, stomach, bowels, &c.; and it often accompanies cutting of teeth, and worms, in children; and a variety of other diseases.

The difficulty of determining to what disease this affection belongs, is only to be removed by knowing precisely, and retaining in the memory, the particular affections which constitute every disease of which cough may possibly be a symptom. This may be illustrated by two examples.

Pleurisy is a compound disease, consisting of four simple affections, viz. pain in the side, shortness of breath, cough, and fever. In this case cough constitutes apparently only one-fourth part of the disease.

Hepatitis, or inflammation of the liver, is distinguished by a pain in the right side, often resembling the pleuretic pain; difficulty of lying on the left side, shortness of
breath,

breath, dry cough, fever, and sometimes pain on the top of the shoulder, vomiting, and hiccup.

Here there are eight simple affections which unite in forming the disease, three of which do not constantly appear in every case; whilst the others are common to both; for a pleuretic patient is often unable to lie on the side opposite to the seat of pain.

A careless or superficial observer may mistake one disease for another, and this actually happened in a case which fell under my own cognizance.

A physician, the quickness of whose imagination sometimes perverted his judgment, declared a patient's case to be a pleurisy, and treated it as such; but upon inspecting the body after death, all the organs supposed to have been the seat of disease, were found to be sound, and the liver very much inflamed, and full of matter.

Many instances of such mistakes might be given; and if a man who has had all the advantages of a regular education, could commit a mistake of this kind, how much more liable must those be who have had few, if any, opportunities of medical improvement.

7thly. The

7thly. The multiplicity of occasional causes which may create such a change in one or more organs, as to pervert their functions, and produce disease.

I have entered fully into this subject under the Essay on Regimen; suffice it at present to offer one explanatory example.

Air is indispensibly necessary to life, and is the natural stimulus to the organs of breathing; but it may be so depraved in its qualities, as either to become a preternatural stimulus, and produce disease; or a noxious sedative, and suspend or destroy the powers of life.

Hence it is indispensibly necessary that the medical man should understand the qualities and effects of cold, hot, moist, and dry air, and all the combinations of these; the nature of all factitious and mephitic airs, lightning, &c.; otherwise it will be impossible for him to obviate their effects.

In like manner the nature and operation of all the other non-naturals ought to be accurately investigated, either as being necessary stimuli for the support of life and health; or as perverted into the causes of disease and death.

Thus

Thus wholesome foods and drinks are not only necessary and natural stimuli to the stomach and intestines, but the chyle produced from them becomes a natural stimulus to all the other organs of the body. On the other hand, it is incumbent on the physician to understand the operation, and foresee the successive effects of excess, or bad qualities, of every article of aliment, not only on the digestive organs, but in the various stages of circulation, secretion, nutrition, and excretion.

This must be a very complicated object of investigation, and affords an additional proof of our art being founded on philosophical principles, deduced from a strict analogical reference to facts.

8thly. As it appears from what has been said under the preceding sections, that a variety of causes conspire to the production of compound diseases, it becomes necessary for the physician to ascertain accurately, and compare with precision, the nature and qualities of each; and what share, separately and combined, they may have in the production of the disease. This is often a very arduous task, and requires a patient and deliberate investigation,

investigation, divested of hypothesis, and conducted on the principles of strict analogical reasoning, grounded, as much as possible, on facts. A single error in the chain of reasoning, by leading to a false conclusion, may be productive of very dangerous practical consequences.

Vomiting, for example, may proceed from manifold causes, and is an affection which accompanies many diseases: Dr. *De Sauvages* has enumerated 37 species of vomiting, and its usual concomitant *nausea*.

Let us suppose that a physician is called to a patient labouring under this affection. From a consideration of the temperament, former diseases, and the patient's mode of life, together with the other symptoms which preceded, accompanied, or followed, the vomiting, he forms his judgment, whether the cause proceed from a constitutional delicacy of the nerves of the stomach, inflammation or schirrus of its coats, weakness of them connected with indigestion, &c.; or whether the cause be seated in some contiguous or remote organ, as the liver, intestines, spleen, kidneys, head, or breast, and affecting the stomach only by sympathy; whether it be
connected

connected with fever, rheumatism, gout, &c.; or whether it proceed from the morbid stimulus of foods, drinks, medicines, or poisons; and how many of these causes combine in its production. The intelligent reader may easily conceive, that very dangerous consequences may proceed from a mistake with respect to ascertaining the genuine nature of the disease, of which this affection constitutes a part.

9thly. The genuine nature of diseases is often rendered very obscure by the influence of sympathy.

Whilst the body is in health, the various organs co-operate and assist each other, in consequence of a general correspondence established by original laws of the system. This co-operation is scarcely discernible in health, though it almost constantly tends to exasperate and disguise diseases, in consequence of the communication between one organ and another, by means of the nervous system.

Thus vomiting is often produced by diseases of the head, liver, kidneys, or intestines; complaints of the stomach frequently bring on head-ach, stupor, and delirium, and affect
the

the heart with palpitation, sense of sinking, and fainting.

In these, and many other similar instances, the physician, notwithstanding his anatomical and physiological knowledge, cannot always guard against deception, whilst the ignorant, by mistaking accidental effects for permanent causes, are perpetually blundering in their attempts to ascertain the nature and seat of diseases, of which I shall give some instances in another chapter.

There is another kind of correspondence between the several organs, which depends less on nervous sympathy, than on a communication established by means of the circulation. This also is a frequent source of error and perplexity in discovering the nature of diseases.

In health every organ is supplied with a certain proportion of blood determined to it by the vital powers, with a degree of force or momentum adapted to the nature and functions of the organs.

But in diseases, this proportion both of quantity and force is changed in an almost infinite variety of ways and degrees; and indeed these changes of determination constitute

stitute a principal part of almost every disease, as is evident from what has been said in Essay I. under the head of Morbid Determination.

Without much care and precaution we may be deceived in attempting to distinguish which of those irregular determinations are essential to the disease.



C H A P. III.

DIFFICULTY OF DISTINGUISHING DISEASES
BY THEIR SYMPTOMS.

Symptom what—Symptoms less numerous than the Diseases they accompany—the Necessity of knowing all the Symptoms of Health, Temperament, Disease, and even the Signs of Death—Errors in assigning Symptoms of one Disease to another exemplified—Sympathy often a Cause of Error—other Causes—A vulgar Error rectified.

A *Symptom* is an effect produced by a cause of disease, either felt by the patient, or remarked by the physician, and by which we distinguish the nature of a disease; this is termed *diagnostic*.

Symptoms are but few compared with the number of diseases of which they are the signs. If we except those symptoms which come immediately under the notice of the physician, and which are not very numerous, all the others proceed from the feelings of
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the patient, which are either absolutely painful, or so far disagreeable and distressing, as to be more intolerable than even pain itself. Such are, sensations of cold, heat, thirst, watchfulness, sickness, languor, and anxiety; each of which appear in a great variety of diseases different in their causes, seat, and nature.

The physician, before he can distinguish one disease from another, must know exactly the signs of life and death, of general health, and that of particular habits or temperaments, which are very numerous; for it is by a previous knowledge of these, and by comparing them with the signs of disease, that we can determine its seat, nature, and degree.

He ought to have an accurate remembrance of all the essential symptoms of every disease, that he may distinguish one from another. We have had an instance of an error in this respect, Chap. II. where one disease was mistaken for another; but in no instance are errors of this kind made so frequently as with respect to fevers; which are of so complicated a nature, and so changeable, that the most sagacious may err, and the ignorant ever do; and to mistakes of this kind thousands annually fall a sacrifice.

Though the characteristical symptoms of *Fever* are but three, quick pulse, increase of heat, and loss of strength, there are others which distinguish one fever from another; others again which are merely the accidental effects of sympathy, and *even* of medicine or regimen. When a Lady Doctor, full of her medical importance, visits her patient, and compares symptoms with Dr. *Buchan's* description, how can she err in forming her diagnostic? It is impossible she should not, destitute as she is of those principles of physiology and pathology which no practical treatise can impart; and which nevertheless are absolutely necessary for the accurate discrimination of symptoms, those especially which are essential to the disease from such as are merely accidental, and probably the effects of bad management. What will be the result of an erroneous diagnostic? An erroneous and dangerous practice, which even Dr. *Buchan* (who I believe to be a good physician) might not be able to rectify.

Another difficulty arises from a single symptom appearing in a great variety of diseases; of this a strong instance was given with respect to cough, and another in the

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case

case of vomiting; and the judicious reader may easily conceive what strange confusion, and extreme hazard, may accrue from assigning either of those symptoms to one disease, when it really belongs to another.

Another source of error is, mistaking effects for causes;—an error into which the ignorant perpetually fall, and which is sometimes apparently countenanced by men of science, from a disinclination to controvert prevalent opinions.

Dropfy is ranked among diseases, though it is in truth but a symptom. This inaccuracy of language does not affect the practice of the skilful physician, but it certainly will mislead those who are unable to reason from effects to causes; for if one cause of this collection of serum in any of the cavities be mistaken for another, the genuine nature of the disease cannot be known.

The power and influence of sympathy create great difficulty. The symptom may appear in one part of the body, and the cause may be very remote; thus cough may proceed from cutting of teeth, &c. and vomiting from a disorder of the head, of the kidneys, &c.

Another

Another great difficulty arises from the patients being unable or unwilling to give an account of their feelings.

Thus children, and persons that are delirious, insane, or in a state of insensibility, are unable to describe their feelings.

With respect to children, a vulgar notion has prevailed that nurses are their best physicians; but it is erroneous.

A person intimately acquainted with the human frame, its nature, and its diseases, has a thousand advantages over those who have gleaned a little bald experience, from which they can draw no useful information; because they are destitute of that philosophical analogy, without the aid of which experience is a mere meteor that leads only to deception.

There is a number of undescribable circumstances in the pulse, aspect of the countenance, breathing, and even the posture of the body, from which a judicious physician may draw a fund of information, of which the ignorant cannot possibly have any conception.

The same remark is equally applicable to persons delirious and stupid in fevers, la-

bouring under faintings, or convulsions, and the melancholy, or outrageously lunatic.

Patients are often, from various motives, induced to conceal the causes of their maladies.

The physician's professional knowledge, which consists partly in a sagacious development of the human heart and character, affords him a clue by which he may penetrate into its most secret recesses. Manifold instances of this might be given, but I shall only offer one, which history has handed down to us, of the son of King *Antiochus*, who was reduced to a state of danger by an ardent yet concealed affection for his mother-in-law. His discerning physician alone could discover the cause: the sequel is well known.

These are a few of the manifold instances which might be adduced, of the difficulty of ascertaining the nature of diseases by their symptoms.

CHAP. IV.

DIFFICULTY OF DETERMINING WHEN AND
HOW A DISEASE WILL END.

*Superiority of Skill manifested by Prognostic—
why—Artifices of the Ignorant—Why Men of
Skill err sometimes in Prognostic—Instances.*

IN no respect is the superiority of the man of skill over the medical pretender so clearly evinced, as his being able to foretell whether a disease will be of long or short duration; and whether it will end in complete recovery, another disease, or in death.

Prognostic implies a prophetic sagacity, grounded on a multiplicity of circumstances compared with each other with philosophical accuracy, from which the physician weighs, as it were, in a balance, the probabilities for and against the event he wishes to investigate.

It is evident, that, to make a just prognostic, a knowledge of the branches of the art enumerated Chap. I. must be attained with great accuracy. If (*e. g.*) we mistake

one disease for another; are ignorant of the nature of the organ or organs which are the seat of the disease; how far they are or are not necessary to life; if we do not nicely estimate the degree of the disease on one hand, and the strength of the constitution on the other; nor foresee all the effects of medicine or regimen which may be prescribed; in short, if we have not a full and comprehensive view of every anatomical, physiological, pathological, and nosological circumstance, we must be totally incapable of predicting the event.

Let us suppose that a person is seized with a pain in the side. Of this Dr. *De Sauvage* makes thirty-seven species, with or without fever, produced either by different causes, or connected with different diseases. The pain is nothing more than a simple affection producing a disagreeable sensation, connected with various diseases, some very slight, many very violent. If we attribute it to a slight cause, when it really arises from a dangerous one, or the reverse, our prognostic must in either case be erroneous.

So in the case of Dropsy, chap. II. if I attribute that which is owing to diseased organs,

organs, and which, for obvious reasons, is seldom curable, to that which is a mere effect of weakness, and is often cured; or the reverse; I must necessarily form a wrong judgment, and an erroneous prognostic.

To avoid the disgrace of making a false prognostic, the ignorant and empirical avail themselves of an artifice which men of skill disdain to make use of; they determine to err on the safe side, and predict danger on every occasion.

I have known more than one man, who, though grossly ignorant, made use of this expedient, and announced danger in every case. If the patients died, their reputations were saved, because they had foretold it; if they recovered, the Doctor's reputation was established by an opinion that the patient was saved by his superiour skill.

It may fairly be asked, Do men of skill never err in prognostic? I answer, they frequently do; and for this several reasons may be assigned.

Sometimes they do so from inattention or hurry; and none are more liable to it than those who are immersed in a multiplicity of business; who, depending too much on their
experience,

experience, do not attend to all the circumstances, but are contented with a superficial and imperfect analogy: but if such men err with all the advantages of a liberal education, what are we to expect from the ignorant, who have no rational principles to guide them?

But a physician may err, how attentive and skilful soever he may be, and this unavoidably.

The disease may be so obscure, and inscrutable in its nature, as to baffle his utmost sagacity: even here, however, the judicious physician, though he know not precisely what the disease is, may, from the general principles of his art, an accurate examination of the state of the different functions affected by the disease, and a strict attention to all the changes it undergoes, especially from the operation of medicines, attain to such a knowledge of its general tendency, if not of its particular nature, as not to commit any essential error in the treatment of it, and, by patience and perseverance, will generally succeed, if the disease be curable.

How does it fare with the ignorant under these perplexing circumstances?

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It must, in general, happen, that they are not conscious of the difficulty; for as knowledge is necessary to the detection of error, so ignorance and diffidence are seldom concomitant: or should a gleam of light break in upon them by accident, it only serves to redouble their embarrassment, unable as they are of making use of a scientific analogy, the principles of which they do not understand.

I shall have occasion, in the next chapter, to consider some circumstances which may tend farther to elucidate this subject.



C H A P. V.

DIFFICULTIES ATTENDING THE CURE
OF DISEASES.

Prognostic of little avail, but as it leads to the proper Treatment of Diseases—how it does so—Medical Art a Circle—Physician why compared to the General of an Army—The ignorant Practitioner to a Partizan—Materia Medica how divided—Remedies to be used in a certain succession—exemplified—Errors in Medical Practice exemplified—Contra-Indication why the source of Perplexity—Regimen why necessary—how abused—Difficulty of managing Diseases from a Change of their Nature—Danger from unskilful Treatment—Why Physicians fail in the cure of Diseases—Why the Practice of Physic in this kingdom is on a bad footing—various Causes assigned—The Improvement of the Art to be attributed to Physicians—Objections to this Opinion obviated—A just Tribute of Praise to Baron Dimsdale—An enquiry how far Nature may be said to cure Diseases—Allegations against the Utility of the Medical Art answered—Why Empiricism ought to be discouraged, and how.

WERE the art of prognosticating the event of diseases a mere matter of curiosity, or a speculative trial of skill, it would be of no consequence whether our predictions

predictions were well or ill founded; but this is far from being the case.

Every branch of our art is so intimately linked to, and connected with, each other, as it were in a circle, that should a single link of the chain be broken, every thing must be thrown into confusion.

The judicious reader, who has perused the preceding chapters with tolerable attention, must anticipate me in the remark I am about to make,—That if a medical practitioner be deficient in the anatomical and physiological knowledge of the human body and mind, and the nature and causes of their manifold diseases, as distinguished by their peculiar symptoms, it will be impossible for him either to foresee the event of the disease, or to cure it, unless by accident.

Thus it is that our art consists of various parts arranged in a certain scientific order, each of which ought to be contemplated in succession, and compared with each other, according to the rigid geometrical and logical rules of analysis and analogy.

It may be proper, however, before we proceed, to explain a little more minutely the connexion between prognostic and practice.

It

It is evident that if we are ignorant of the nature of a disease, we cannot foresee the event; but it is not so clear how necessary an accurate prognostic is to a successful practice.

Let us suppose that a person complains of a pain in the side; it may be spasmodic, rheumatic, or inflammatory, &c. If from all the circumstances I know it to be spasmodic, I foresee that it will terminate soon, and without danger; if rheumatic, that it will probably be tedious in its progress, but scarcely dangerous; but if inflammatory in a high degree, that it will be rapid in its progress, attended with considerable danger, and may probably be fatal.

If I mistake the third kind for the first, and am led to prognosticate erroneously, this must evidently affect my practice; because, deeming the disease slight, I neglect the early use of the most powerful means, and lose an opportunity of saving the patient, which can never be retrieved.

If, on the other hand, I treat the first as a pleurisy, I may bleed, or otherwise discipline, my patient into a state of dangerous weakness; and increase the evil, instead of curing it. This is not a fictitious supposition, but grounded

grounded on truth; and this and similar blunders are daily committed.

Indications of cure are those circumstances in the nature of a disease, which point out what is to be done for the relief of the patient; it is, in truth, a scientific plan laid down upon the principles of physiology and pathology.

If a physician be called to a patient ill of a pleurisy; having ascertained the disease, he asks himself what are the general indications of cure? They are, to weaken the propulsive power of the heart, and the rapidity of the circulation, by which the inflammation of the pleura and lungs is supported: and to pursue this plan until all danger of an imposthume or mortification is anticipated; to use every means which may be conducive to the mitigation of the local inflammation; and to prescribe such medicines and regimen as, being *sedative*, may lessen the febrile commotion, and increased determination on the diseased organ.

Thus the physician may be compared to the General of an army, on the point of giving battle to the enemy. From the force and arrangement of his enemy, he forms his plan;

plan, by which he provides for making the most vigorous attack where the most powerful resistance is expected, for changing his plan as circumstances may require, for throwing in assistance where it may be most necessary, and for rectifying errors as they may be occasionally committed.

Having digested his plan, he then examines his *roster*, and selects those troops that are fittest for the most vigorous exertion, and such as are best suited for an auxiliary reserve.

In like manner the physician always forms his plan, before he examines *his roster*, or the *Materia Medica*, which are the instruments by which he is to attack, and hopes eventually to conquer his enemy.

What does the short-sighted practitioner, or the ignorant quack? He acts like the rash partizan; he falls on *pell-mell*, ignorant of consequences which he can neither foresee nor provide for.

He forms no plan, because he has no principles upon which to ground it; he bleeds, blisters, purges, &c. without being able to assign any other reason than that it has been customary to do so, and that persons have sometimes recovered by these means; but he has no conception of the nice discriminating

circumstances on which a rational practice is founded.

In the case of dropfy, (*e. g.* of the belly) having formed an erroneous opinion of the nature and event of the disease, he with great confidence sets about the cure with a remedy he deems *infallible*; because, like *Mr. T.'s medicine*, and many more, it has sometimes succeeded.

Should it even succeed in discharging the serum, which might be more certainly done by tapping; and has been done by a draught of cyder, butter-milk, and even water; what does he gain by it but temporary relief for a few days? because it does not remove the radical cause, which, in nine cases in ten, is absolutely incurable, and the belly swells again. Will his infallible remedy succeed again? it is ten to one that it does not; and this, for reasons sufficiently obvious to men of skill, has ever been, and ever must be the case, with all the *infallible* remedies that ever were or will be invented; for, as a late excellent physician^a remarked, though the ignorant boast of infallible remedies for every disease, a man of skill cannot afford a positive assurance of his being able to cure a cut finger.

^a Dr. Gregory of Edinburgh.

The *Materia Medica*, being very extensive, is, for the sake of precision and perspicuity, divided into classes, orders, genera, and species. Some of these classes restrain the motions of the circulation when too violent, or increase them when languid. Some mitigate the sensibility of the nerves when too great, others increase it when deficient. Some promote the evacuations; others regulate or restrain them; and others are what are called alterants, or such as are supposed to rectify faults of the blood and humours. Of each of these classes there are various genera and species, endowed with different degrees of power; and much skill is required in adapting the remedy to the degree of urgency, and the ability of the constitution to bear it.

The physician, in the case before us, having determined what to do, next resolves how it is to be done; that is, he turns over in his mind the various classes &c. of the *Materia Medica*, and selects certain articles for the purpose.

These must be exhibited in a certain order and succession;—a circumstance of great consequence, in which the ignorant generally fail.

This,

Thus, in a colic, an old nurse shall often give a dose of Turlington, or *a dose of gin*, when a purgative ought to be previously given; after which the hot remedies may not always be improper.

In all cases, the most urgent indication, or that which strikes more immediately at the most dangerous part of the disease, is to be first satisfied: Thus we bleed as early as possible in inflammatory diseases; and we repeat it as often as it is necessary, until we have placed the patient as much in a state of safety as can be effected by this article of the *Materia Medica*.

In cases of danger, as many means ought to be used, tending to fulfil the same indication, as the nature of the disease requires, or the strength of the patient will permit: Here also the ignorant often err, from being incompetent judges, either of the urgency of the disease, or what the constitution will bear.

Hence they are often remiss in carrying the grand indication into effect, by not bleeding sufficiently early, and copiously; and the patients either die of a mortification, or fall into a consumption, from imposthumation

of the lungs; or, like *Sangrado*, they bleed them within an inch of their lives; and cure the patients of a pleurisy or fever, by disciplining them into a dropsy.

Another circumstance which often perplexes the skilful, and must ever embarrass the ignorant, is what we call *contraindication*; that is, some circumstance which forbids our either pursuing a very essential indication at all, or to the extent which might otherwise be necessary.

Thus exquisite pain demands opium, and the nature of the disease may not admit of it. If I am called to a patient late in a pleurisy, who has not been bled, he may be so far exhausted by the disease, that I cannot, without hazard of destroying him, take away as much blood as may prevent imposthumption or gangrene; so that I have only a choice of difficulties.

Another difficulty is, the proportioning the remedy and its quantity, with a reference equally to the nature of the disease, and the ability of the patient to bear it.

Here age, sex, constitution or temperament, and a variety of other circumstances, are to be taken into the account; and hence considerable

derable difficulty arises in adjusting and accommodating remedies to all these.

Medicine alone is seldom sufficient for the cure of disease. Regimen therefore ought to be called into its aid; and it should be exactly adapted in its nature to that of the remedies, both being necessarily adverse to the disease.

For this purpose, a very accurate knowledge of the nature and operation of the various articles of regimen becomes necessary: an important and extensive object of study, with which few practitioners are so conversant as they ought.

The ignorant often counteract the salutary effects of medicine, either by neglecting appropriate regimen altogether, or by adopting such as is of an opposite nature: Thus, in high fevers, hot rooms, close curtains, and hot drinks, often effectually destroy the good effects of cooling remedies.

Diseases often change their form and aspect, and even their nature: it therefore requires much knowledge to mark the gradual transition from one state to another. Thus, inflammatory fevers may become putrid, high fevers become low, and agues may be con-

verted into fevers of a remittent type: and the same happens, though not so frequently, or remarkably, in other diseases.

This is often the result of bad management, which the unskilful have not sagacity to foresee; nor, when it happens, to remedy; if they have not, as too frequently is the case, put it out of the power, *even* of men of skill, to avert the danger which their ignorance alone has created.

Do physicians never err in the management of diseases? It would be illiberal and uncandid to assert that they do not; but their errors are comparatively few and trivial; and their scientific knowledge often enables them to rectify their errors, before it is too late; and to extricate themselves from difficulties which the ignorant are neither able to discern, nor to compensate, could they discern them.

But a physician's want of success, in curable diseases, is very rarely to be placed to his account. His most judicious plans may be counteracted by drugs bad in their kind, or unfaithfully prepared: he is often disappointed by the negligence of nurses, and the obstinacy or whimsical prejudices of the patients or their attendants; and as many circumstances

cumstances of great consequence, with respect to omission or commission, are most industriously concealed from him, he is thereby led to make a false estimate of the nature of the disease, and of the operation of his remedies.

He is often, *in this kingdom*, and *in this kingdom only*, of all the countries in Europe, called in so late as if he were merely to be employed to close the eyes of the patient.

It is not my intention to fix obloquy on any order of men. Of the apothecaries, as of all other ranks in society, there are men of various degrees of ability and merit; and, as I have observed in another essay, I doubt not but there may be *some*, who, without the credentials, may possess the skill of physicians; but they are rare; and the public is unable to distinguish them from their ignorant, and, generally, more presuming brethren.

But apothecaries becoming prescribers, and thereby departing very far from their original destination, is not to be laid to their charge; for they have been *absolutely forced into their present situation*, partly by the absurd custom of this country, the only country in Europe wherein they are so employed; and partly from the established fees of physicians,

which are here as much too high, as they are elsewhere mean and beggarly.

When a new disease arises, or common diseases assume a new aspect, it is the skilful physician *alone*, who, by the aid of established principles, can devise a new mode of treatment, corresponding to the novelty of the case.

When the ulcerated fore throat appeared in this kingdom, and the ordinary practitioners stood aghast at the sudden and unexpected fatality of the disease; and many had fallen a sacrifice to the baneful effects of this new epidemic; it was a physician^a who discovered its genuine nature, and pointed out the remedy.

Forty years ago a pleurisy was epidemic in our fleet, and many died under the usual mode of treatment, until Dr. *Huxham* discovered it was of a malignant nature, and would not bear bleeding; the most essential remedy in the common pleurisy.

It may be said, that physicians arrogate too much, and that valuable remedies have been discovered by persons who were not physicians; and of this the Peruvian bark is an in-

^a The late Dr. Fothergill.

stance;

stance; the efficacy of which was accidentally discovered by an Indian. The fact is not to be disputed; but it was reserved for physicians, not only to regulate its use, even in the single disease in which chance had shewn it to be beneficial; but to extend it to many other diseases, of which none but the judicious could have any conception; as they alone could avail themselves of rational analogy.

Another instance may perhaps be given, of the new mode of inoculation. But, besides that the hint was evidently taken from the celebrated Dr. *Sydenham*; the practice was empirically concealed from the public, until a physician^b, who is an honour to his profession, to his country, and to human nature, drew aside the veil, applied it with great judgment to the lessening of the danger of the confluent small-pox, and modified its application in inoculation.

It has been alledged, even by some medical men, that we are often indebted to Nature for much of our success; and that our patients would more frequently recover, if we interfered less with her salutary operations.

^b Baron Dimisdale.

I have made some remarks on this subject on another occasion; but I shall also take some notice of it here.

The term *Nature* implies that our machine is directed and regulated by an intelligent, sapient Being: but no such agent exists in our bodies. The disciples of the celebrated *Stahl* attributed this superintending power to the soul; others have insinuated, that our corporeal centinel is a kind of *good genius* which watches over its safety.

But manifold instances might be brought to prove, that what are called efforts of nature are nothing more than certain movements of our various organs, indispenfibly arising from the laws of animation and sensation: That is, when a stimulus, whether natural^c or morbid, acts upon a sensible organ, it either reacts, if a muscular organ, or if not, conveys to the mind certain impressions, always in a compound ratio of the degree of stimulus and of sensibility.

We have the most indubitable proofs that Dame Nature, (for this non-entity, like many other imaginary beings, has been personified

^c This is explained fully in the Natural History of the Human Body.

and converted into an old nurse) instead of evincing any instinctive sagacity, blunders as much, and as egregiously, as any quack or old woman in the kingdom; and in her attempts to relieve her ward, makes the very efforts which tend to its embarrassment and distress. When a biliary concretion drops into the gall-duct, the cavity of which is generally too narrow to allow it to pass, What does her sage ladyship do? Were she to act wisely, she would either send it back, or, by relaxing the duct, procure it an easy passage: But the contrary of all this happens; for the stimulated and sensible duct contracts upon and grasps the offending body; and by lessening its diameter, increases the difficulty: The physician, on the other hand, corrects her blunder, and uses a variety of rational means to enlarge the cavity, and promote the passage of the concretion.

On this occasion nature does not act contrary to the laws of the constitution, but precisely in conformity to them; the error consists in expecting that she should act otherwise, and in attributing to her powers which she does not possess.

The same observation may be extended to every other disease, *even fever*; in the salutary termination of which she is supposed to have so great a share, that a very ingenious author^d has insinuated, that nature and the nurse do the business more rationally and effectually than the doctor; yet this gentleman has been so unaccountably inconsistent, as to employ more than half of his volume, in giving minute directions for the cure of those very diseases, which he had previously alledged were better managed by nature and her co-adjutrix.

Are there therefore no efforts of nature? None, in the usual acceptation of the term.

Persons (say nature's advocates) recover without the use of medical means: how does this happen? I answer, that the disease has been either very slight; or if otherwise, we may easily account for the accidental relief obtained, especially in febrile diseases.

During the different perverted determinations^e of the circulation, in consequence of febrile tumult, it may luckily happen, that by the bursting of some blood-vessel, of the nose for instance, the discharge may com-

^e This term is explained in the Natural History, &c.

open fate for the want of bleeding; or some of the excretions being thrown open, the want of emetics, cathartics, sudorifics, expectorants, &c. may be supplied; as it is by these means physicians increase the evacuations. Hence it is that fevers, inflammations, and other diseases, have sometimes been happily terminated *by chance*, and not in consequence of any design, concerted plan, or instinctive interposition of nature, as has been, very unphilosophically, supposed.

The truth therefore is, that a skilful physician may render most essential service, by a judicious mitigation of the constitutional movements when too violent, a proper direction of them when irregular, and a due excitement and support of them when languid and depressed; and, after a more extensive experience of forty years than has fallen to the share of most men, I do most solemnly declare it to be my firm belief, that the medical art, if judiciously employed, may be most essentially useful in the preservation of life, and the cure of diseases.

The uncertainty of our art, and the ignorance and blunders of its professors, have long been subjects of sarcasm and ridicule; from

from which a careful and attentive perusal of this essay, and another^f, will, I flatter myself, rescue it, in the opinion of the learned and judicious readers, who will readily acknowledge, that our mistakes in distinguishing, and our failure in curing diseases, are not so frequently, as is alledged, the result of ignorance or inattention; but because we are not endowed with supernatural intuitive powers, and cannot discern and accomplish, what it is impossible for finite beings to know and effect.

For besides the impediments to our success, which have already been enumerated, it is often impossible for us to save life, when from previous neglect, mismanagement, or the extreme violence of the disease, the physician finds the structure of the diseased organs to be so much perverted, that nothing but a miraculous interposition of the great Author of our being could possibly restore them.

But whilst medical men, with all the advantages of a regular professional education are accused of ignorance, presumption, and imposture; how exceedingly absurd and ridiculous must it be, for any person of common

^f Natural History, &c.

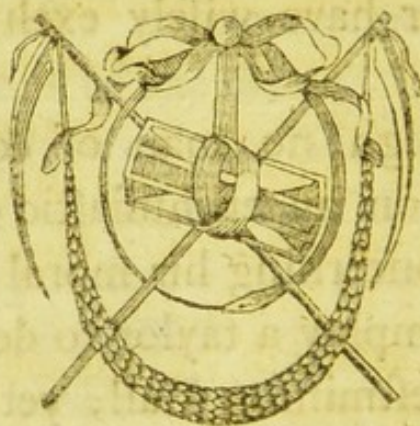
mon sense to conceive it to be possible that quacks and medicaſters can, in any degree, be competent to the care of health or the cure of diſeaſes, deſtitute as they are of every ſcientific principle; and who therefore can have no guide or reſource but what blind chance affords them.

Divinity, law, and phyſic, are juſtly deemed *learned* profeſſions; and legiſlative authority has limited the regular exerciſe of thoſe profeſſions to ſuch perſons *only* as are qualified by a regular education. However, the benign ſpirit of toleration has *permitted* religious empiriciſm, and *folly has countenanced medical quackery*; but the Courts of Weſtmiſter have wiſely excluded illiterate interlopers.

But though no man of common ſenſe would rely on an enthuſiaſtic cobbler for inſtruction concerning his moral and religious duties, or employ a taylor to defend his property in Weſtmiſter Hall; yet, *ſtrange infatuation!* perſons not deſtitute of diſcernment in other reſpects, daily truſt their lives and healths to miſcreants, who are as little qualified to practice phyſic, as a cobbler is to preach, or a taylor to plead a cauſe.

It

It may be said, that from the extreme credulity and cullibility of the inhabitants of this kingdom, it will be impossible to stem the torrent of empiricism. I am, however, firmly persuaded, that, were persons of improved understandings thoroughly convinced that it would be their interest, and duty, to protect and support the regular profession of physic, such is the force of example, that the ignorant would be gradually weaned from their attachment to quacks and quackery.



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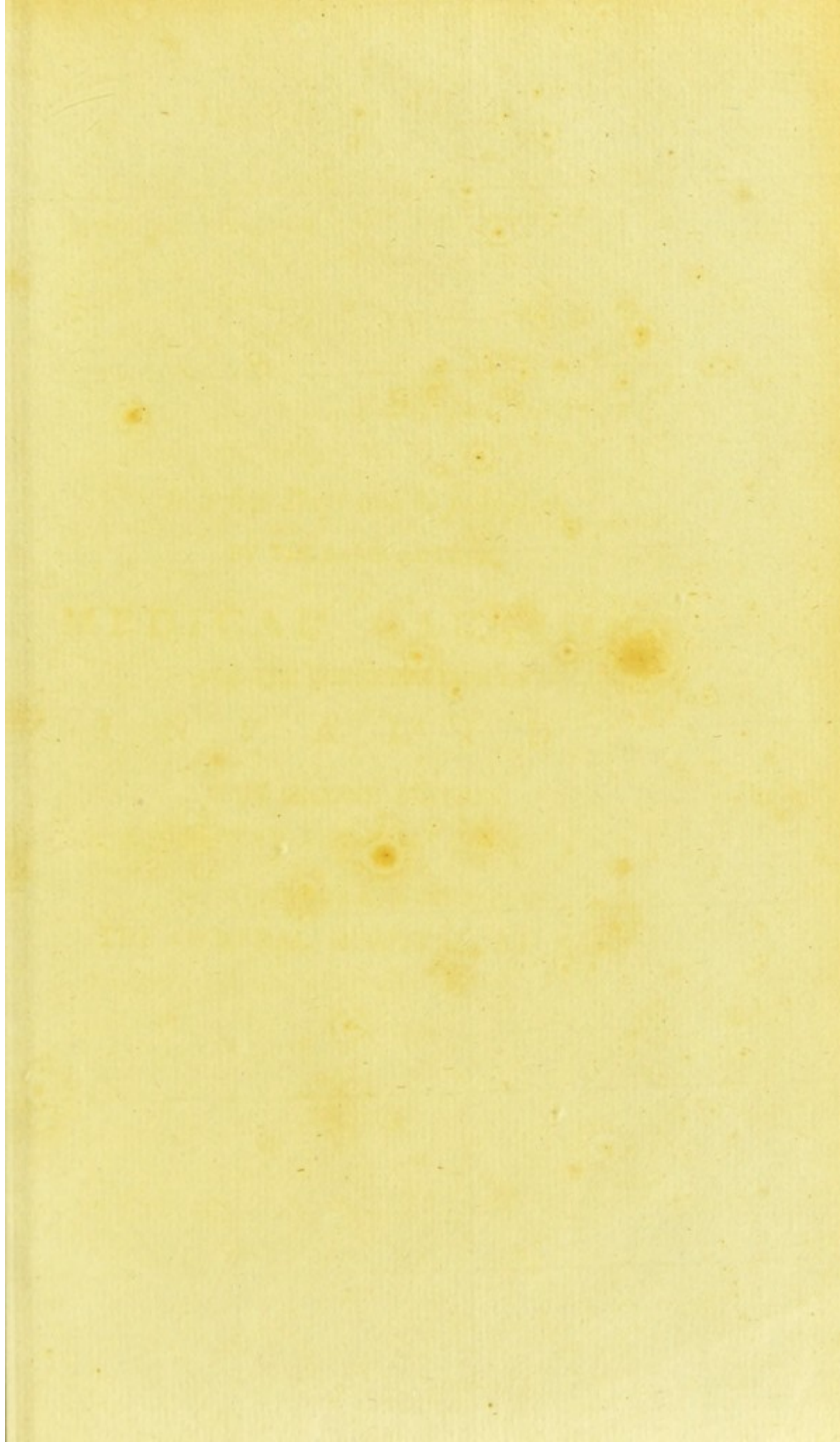
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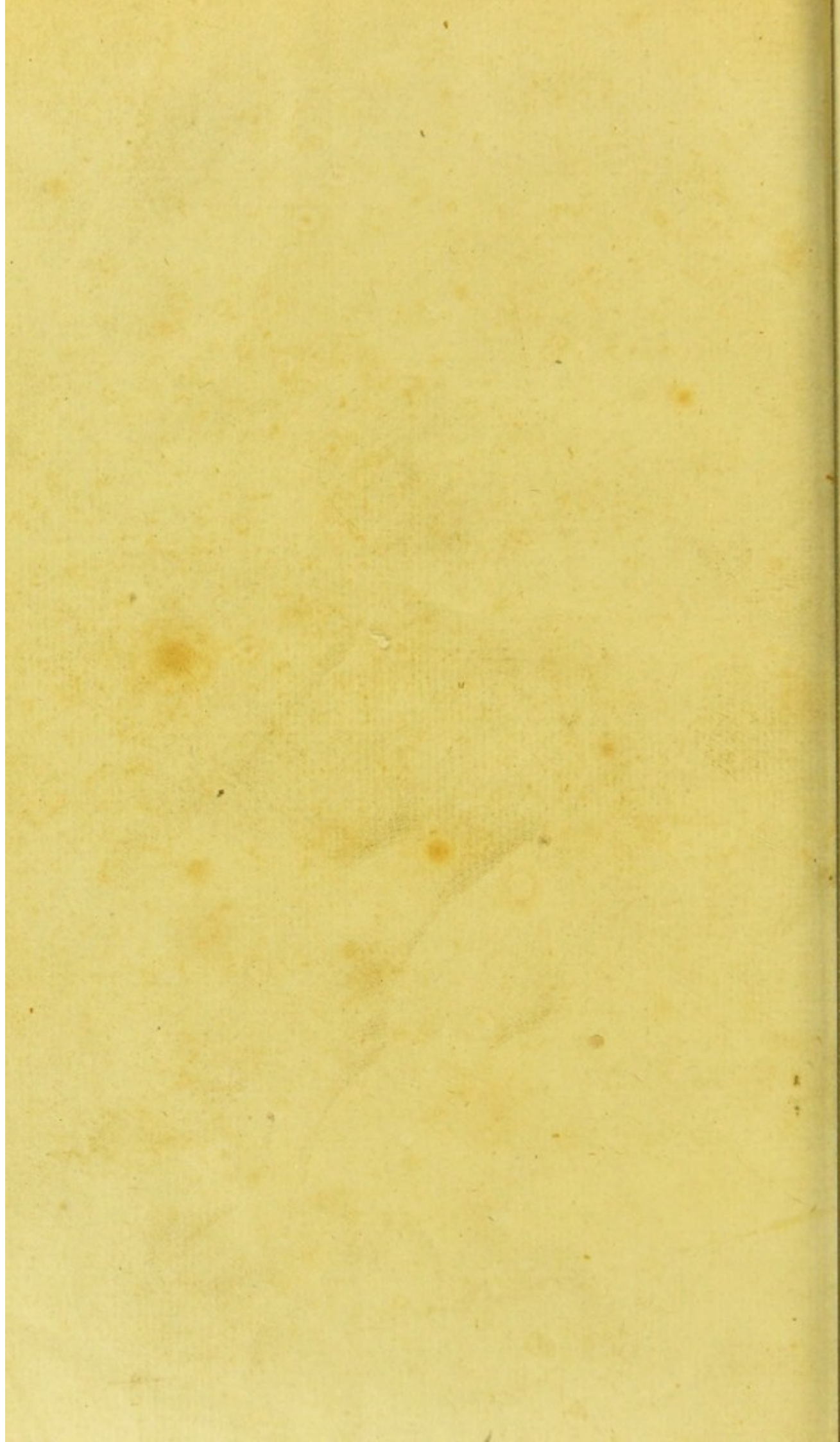
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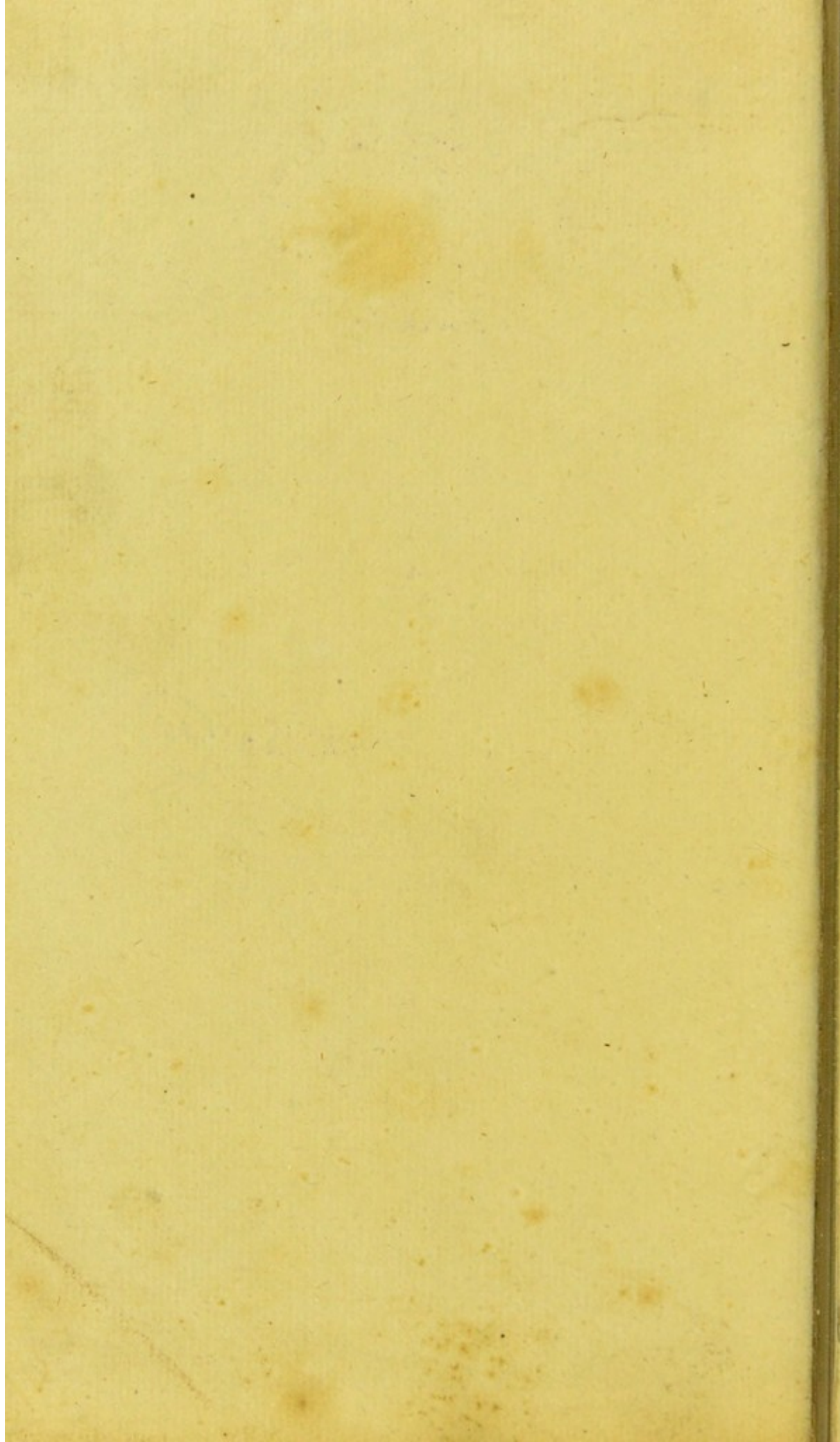
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