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ELEMENTS

OF

MEDICAL LOGICK,

OR

PHILOSOPHICAL PRINCIPLES

OF

THE PRACTICE OF PHYSICK.

BY

SIR GILBERT BLANE, BART.

FELLOW OF THE ROYAL SOCIETIES OF LONDON, EDINBURGH, AND GÖTTINGEN, MEMBER OF THE IMPERIAL ACADEMY OF ST. PETERSBURGH, AND FIRST PHYSICIAN TO THE KING.

THE THIRD EDITION, WITH LARGE ADDITIONS.

ΙΑΤΡΟΣ ΦΙΛΟΣΟΦΟΣ ΙΣΟΘΕΟΣ.

Ἱπποκ.

LONDON:

PRINTED FOR THOMAS AND GEORGE UNDERWOOD,
FLEET-STREET,
BY W. NICOL, CLEVELAND-ROW, ST. JAMES'S.

1825.

ST. THOMAS'S LIBRARY HOSPITAL.

To the Library of St Thomas's Hospital
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KING'S COLLEGE LONDON

TO

THE KING.

SIRE,

I HAVE been induced to solicit the sanction of YOUR MAJESTY'S Name to this Work, from reflecting that the subjects of it have arisen not merely out of ordinary Professional Duties, but out of a course of Public Duty, in which it was my lot to witness and to act a humble part, in some of the most splendid events of British History, or during a period in which I have had the honour of being engaged in the service of YOUR MAJESTY'S Person and Family. In a profession which has for its end the alleviation

of human misery, and the saving of human life, it has been my aim, to the utmost of my inadequate powers, to extend its utility and uphold its dignity, by founding it on the deep and solid basis of genuine Science and sound Philosophy, as the most acceptable service I could render to a Monarch, who, as He is the Father of His People, so is He the object of their veneration and affection. And I count it one of the happy incidents of my long life, that in addition to all the ordinary motives to the discharge of my duty, I have felt my labours sweetened, and my exertions animated, by the further incentive of rendering myself, if possible, not unworthy of the distinguished confidence and encouragement of a Sovereign, who has been pleased to place me in the highest post of my profession,—who is the Patron of Literature and Science, as well as of all the useful and liberal Arts—of a Sovereign also, by whose wisdom and vigour, seconded by the matchless energies of a free, a loyal, a virtuous, and valiant nation, Europe has been rescued from

subjugation and oppression, through a series of atchievements, which in lustre and effect, surpass whatever has been recorded in the Annals of the World.

I entreat YOUR MAJESTY to accept this tribute of the homage and attachment of

YOUR MAJESTY'S

most dutiful, most devoted, and

faithful Servant and Subject,

GILBERT BLANE.

Errors and Omissions.—To front the Advertisement.

Page 33. In the enumeration of the principles of life, transpose the words *Sympathetick* and *Appetitive*.

Page 48. In the middle of the page, for the numbers 111 and 112, read 211 and 212.

Page 97. In a note, by reference from the word *iodine*, say, See a treatise on this subject, by Dr. W. Gairdner, Lond. 1823; another, by Dr. Manson, of Nottingham, Lond. 1825.

Page 102. In the second line from the bottom, for the word *plan*, read *plant*.

Page 108. In the second paragraph, for *leaves of plants*, read *petals of flowers*.

Page 217. Nine lines from the bottom, for *callas*, read *callus*.

Page 303. Eleven lines from the top, for *impetuous*, read *imperious*.

ADVERTISEMENT.

THIS Work was first submitted to the Publick in the year 1819, and having been for some time out of print, after undergoing a Second Edition, the Author has judged it due to his readers, for this indulgent reception, to take more than ordinary pains in the preparation of a Third Impression. His original purpose was to supply what he considered a *desideratum* in Medical Literature, namely, an Exposition of the Rules of Correct Reasoning, and of the Sources of Error in Practical and Theoretical Medicine Authors themselves cannot, either with a due impartiality, nor without a violation of decency, pass a judgment on the merits of their own works; but in justice to the judgment and taste of others, he is bound to believe, after such manifest approbation, that his labours are not quite devoid of usefulness, novelty, and interest. It becomes him then to endeavour to give some farther value to this Work, in order as well to justify Public Opinion, as to express his own pride and gratitude, and he has therefore, in addition to the discussion of such subjects as fell in his way, in prosecution of his original object, so enlarged his matter, as to make the whole assume the form of a compendious System of general Professional Instruction.

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ELEMENTS

OF

MEDICAL LOGICK,

&c.

INTRODUCTION.

As medicine has for its object the preservation and restoration of health, it comes under the definition of an Art, a term, the import of which consists in the adaptation of means to ends. These means must be derived from the previous knowledge of the changes producible by them, whether as corporeal agents constituting physical causes, or as affections of the mind, constituting moral causes.

The most precise criterion that can be fixed upon for distinguishing rational beings from brutes, is the faculty of adapting means to ends; and there is perhaps no attribute purely intellectual, to which the term *reason* is so appropriately applicable.

It is this which characterises the intellectual nature of Man, as his moral nature is characte-

rized by that free agency which renders him an accountable being. These are the two attributes which together with the faculty of comprehending and discovering the relations of quantity, belonging to the abstract affections of space, time, magnitude, and number, in other words, what is understood by mathematical truth in its most comprehensive sense, constitutes the insuperable barrier separating the inferior classes of animals from man,

Sanctius his animal mentisque capacius altæ.

Language has very commonly been assigned as the distinctive faculty of rational nature; but it requires little reflexion to perceive, that, under this definition of art, language itself is an art, for it consists in the contrivance and employment of the *means*, articulate sounds, for accomplishing the *end*, the interchange of thought between one intellectual being and another; and the logical process of thought, by which children first catch the import of words, is an example of the same sort of induction, by which cause and effect are ascertained.

The principles here stated, explain also that susceptibility of improvement in the mental capacity of man, in his career of infinitely progressive knowledge, which so strikingly distinguishes his condition from the stationary nature of mere animals.

And (if the remark is not here out of place) does not this pre-eminent privilege of man, coupled with the fond aspirations of the human heart, which it would be contrary to the analogy of the rest of nature, to suppose to be implanted in vain, lend an additional assurance to the hopes of those who promise themselves a state of existence beyond the grave?

It follows from what has been said, that as it is physical influences with which we have chiefly to do in medicine, the main and ultimate object in cultivating this art, must consist in ascertaining the agency of external objects, whether salutary or noxious, on the living body, and in applying or avoiding them so as to obtain the desired result, either of preventing the occurrence of disease, or in converting the state of disease into that of health. It is in the extent and correctness of our knowledge of these agencies, that the perfection of the art of physick must consist.

This knowledge has to some persons of a sceptical turn of mind, appeared so unattainable, as not to be worth prosecuting, insomuch that they have even raised the previous question, *an datur ars medicinæ?* They allege that the powers and resources of nature in the human, as in the brute creation, are all-sufficient; that we do not possess such a power over the agencies of nature,

nor such a knowledge of their application, as to constitute an art; that the history of this pretended art in all ages, so teems with the fanciful influence of superstitious observances, the imaginary virtues of medicines, with nugatory, delusive, inefficient and capricious practices, fallacious and sophistical reasonings, as to render it little more than a chaos of error, a tissue of deceit unworthy of admission among the useful arts and liberal pursuits of man. There is indeed a certain portion of the enlightened members of society, who allege that physiology, and the inferences deducible from it, by which we affect to ally our art with genuine science and philosophy, are so vague and unsatisfactory, as to admit of no application to the relief of human suffering, and who consider the belief in the virtue of medicine, as little better than a mass of vulgar error, to be discarded from a liberal mind almost as much as the delusions of supersitition.

As these allegations strike not only at the dignity and importance, but at the very existence of medicine, they loudly call for an answer; and we hope to shew that what Bacon affirms to be true, with regard to religion, is equally so with medicine, namely, that the two extremes of plain and profound meet, that those who plume themselves on having beat down credulity and prejudice, are themselves most in error, and that the superficially learned are often the most unbelieving.

The argument from the brute creation seems plausible enough, and it might have been added, that whole tribes of the human race pass through life without the benefit of any regular art of physick. But though animals are very little subject to disease, compared to the human species, it is not strictly true that they use no remedies, for they are observed to swallow certain simples to relieve themselves from disorders. Neither are the untutored tribes of mankind without their valuable remedies discovered by natural sagacity, and some of their greatest sources of misery consist in their having so scanty a stock of them, and the want of those means of relief when under suffering and danger, which are known and successfully practised in civilized life. The works of the most authentic travellers abound with proofs of this. It is also remarkable, that savages seldom attain to old age, though their disorders are much fewer, and the mechanical injuries to which they are liable, are much less frequent than among nations cultivating the arts and sciences; and it is incontrovertible, that if the powers of unassisted nature were all-sufficient, all mankind, whether in the savage or civilised state, would die of old age, which is far enough from being matter of fact.

The maladies and casualties incident to the human species are more numerous and complicated

than those of other animals, in consequence of the artificial habits and practices peculiar to rational beings, and they are still more multiplied by that superior cultivation of reason which distinguishes civilized from savage life. The exercise of reason has also a tendency to obliterate, or at least to weaken such suggestions of instinct as animals possess, and those dictates of natural sagacity, which are found among savages, and which nature has implanted for the protection of both; but even in the rudest state of society much is left to reason, as is observable in the helpless condition of the infant in every situation of human life.

And with regard to the vagueness and uncertainty of physick, in its principles as well as practice, all the maxims and practical operations of human life lie open to the same objection. They all consist of facts and principles which do not admit of mathematical precision; being made up of averages and approximations, all liable in various degrees to error and exception. This cannot be better exemplified than by the mariner's compass, the value of which, consists in its indicating the bearings of different points, with regard to the poles of the earth; yet it never points to them, except at those moments when in the course of its perpetual aberrations, it passes from one side to another, so that it may be said to be in

a state of constant and fluctuating error. But does it follow from this, that this instrument, perhaps the most interesting ever discovered by human art, is to be rejected?

From these considerations, it is obviously in accordance with the wise and beneficent arrangements of Providence in other departments of creation, that compensation should be made by reason's proving a corrector of evils which reason had induced, so that artificial ills should be counteracted by artificial remedies. This is presumable *a priori* from the analogy of nature; but it is not only presumable, but incontestibly true in fact, that most diseases are more or less under the controul of art; and one could be named of such potent malignity as would have gone far towards the extinction of the human race, by striking at the very source of life, had it not been resisted by the power of art. And those must be morbidly sceptical who will deny that the superior health and extension of life in this age and country,* is in great part imputable to the improved state of medicine. It may here be further remarked, that there are none of the departments of medicine which have been more run down by witlings and sciolists than the obstetrical art. Their main argument, which is certainly not very

* See Select Dissertations on several subjects of Medical Science, page 179. By Sir Gilbert Blane, Bart. London, 1822.

complimentary to the civilized world, is drawn from what happens in the case of brutes and savages. They triumphantly allege that parturition is sufficiently safe among both these, without the interference of art. But the considerations above adverted to, seem sufficient to repress these hasty and flippant animadversions; for the physical structure and temperaments of individuals in civilized life, particularly in the more tender and flexible sex, in consequence of the artificial habits of refined society, are such as to render parturition liable to accidents and influences unknown among brutes and savages. It is true that these occurrences are comparatively rare, but men enlightened by professional education, are equally useful by protecting those who form the majority, that is, the cases in which the efforts of nature are all-sufficient, from the ignorance and officiousness of those who are incapable of judging in what circumstances, and to what degree nature requires or admits of the assistance of art.

These examples, illustrative of the utility of our art, are drawn from curative medicine; but instances equally important and convincing might be quoted from the history of preventive medicine, in the various means which have been devised and practised for obviating and extinguishing infections, engendered by the artificial habits of

human life, in the more or less cultivated stages of society.

The unbounded number and variety of powerful agents under the command of art, by which the living human frame can be acted upon, afford further ground for admitting that physick is a real and efficient art. These consist not only in the regulation of diet, of the temperature and purity of the air, and the abstraction of blood, but there is such an ample and beneficent provision made by nature in the productions of the vegetable, mineral, and animal kingdoms, so diversified in their peculiar and respective virtues, as to be co-ordinate with a parallel diversity of human suffering, and such as to leave no hesitation in interpreting their meaning, as a portion of that system of final causes, so expressively displayed in the whole works of creation. Is there an organ, or function in the animal economy, which cannot be either incited, or restrained by some natural agent discovered by man; and how few are the maladies, which, even in the present imperfect state of the medical art, do not admit either of cure, or palliation by some specific remedy, or mode of treatment already found out, and hereafter to be found out, should succeeding ages be as sagacious or as fortunate as the present in discovering new resources for the alleviation of human misery? It is highly worthy of remark in this place, that as

the diseases and casualties of life are multiplied in the progress of civilization, so are the remedies multiplied by the improved energies of reason, and the cultivation of science, in conformity to that scheme of consistency and harmony which pervades the universe, particularly in all that relates to sentient beings.

Would it not also be an anomaly and blot in the beneficent adjustments of the creation, that human beings, under the extremity of suffering, should, by the impulse of nature, call aloud for relief, without any means being afforded for furnishing it? These calls for relief are indeed so imperious, that inefficient and even pernicious means will be caught at, if those that are efficient and salutary, cannot be procured; so that the dearest and tenderest interests of mankind would be left at the mercy of ignorance, selfishness and fraud, unless society were protected by the light of experience and knowledge. It is too true, that medical practice has been perverted by fallacious reasoning, and by the misapplication of the powerful resources discovered by superior intelligence; and it has been sarcastically said, that though there is a wide difference between a good physician and a bad one, there is but a small difference between a good physician and no physician at all; by which it is meant to insinuate, that the mischievous officiousness of art does com-

monly more than counterbalance any positive benefit derivable from it. This view of the matter takes it for granted, that there is a greater risk of nature being thwarted by professional interference, than by the sick being left in the hands of the uninstructed. But is the uninstructed person more likely to humour and imitate nature, than the educated one; and is not the kitchen as fertile in noxious articles as the apothecary's shop? From all I have been able to observe, the ignorant person is more apt to counteract nature by pernicious interference with her, than the wildest professional theorist; nay, ten to one he or she is the greatest theorist of the two, for every old woman has her theory generally drawn from the humoral pathology. The faculty of clearly comprehending and fairly interpreting the ways and aims of nature, is one of the highest efforts of reason, and is attainable only by attentive study, and a happy turn for observation. If it were further necessary seriously to repel by argument this depreciating sarcasm, it might be urged, that no argument is more weak than that which avails itself of *abuse;* for there is no maxim more true, and few more practically important, than that the best things are the most liable to abuse, *Nil prodest quod non potest lædere idem*; and by the same rule, the most potent means are the most mischievous when misapplied. And the powers with which medicine is armed, forms no exception to this. It

is not meant to deny, that great mischief does not occasionally arise from the unseasonable interference of art with the operation of nature, but as this consists in abuse, it affords an additional reason for the more intense cultivation of the art, in order to save mankind from the misapplication of it. And this is more particularly called for in the present state of natural knowledge, for the many new and potent tools which have been put into the hands of the profession, by chemical and botanical research, may prove swords and firebrands in the hands of the ill-educated and unskilful.

The following practical reproof of those who disparage the art of physick, occurred to the author. He was called up in the night to visit a gentleman of high character in the literary world,* whom he found labouring under an inflammation of the bowels, in its last and incurable stage, and for which no professional assistance had till now been called. Finding himself on the verge of dissolution, he not only expressed regret on his own account, but a sincere remorse on account of others, who might be influenced by his habit of casting ridicule on the medical art in his gay and thoughtless hours. His complaint was, indeed, one in which the efficiency of the medical art,

* The late Mr. Baretti.

seasonably and skilfully applied, is rarely unsuccessful.

To conclude: it is the really enlightened physician alone, who can discern, in each particular case, to what extent art is availing, or if it is at all availing. But at all events he is bound not to desert his patient; and while he himself forbears from doing harm, it is his duty to protect those who are so eminently exposed to the over-active officiousness of others. He will also (if I mistake not) feel it incumbent on him in such moments, to administer the moral remedies of consolation and sympathy, and to assuage the anguish of despair, the most acute of all mental sufferings, unless we except the pangs of remorse. Those who conceive the whole art of medicine to consist in wielding the powers of the Materia Medica, entertain a narrow and unworthy conception of their own duty, and of the value and dignity of their profession.

The scepticism which has here been combated is a disease of the mind, which, like some of those of the body, is the offspring of over-refinement. But the great mass of error with which medicine has been encumbered, or as it were overlaid, has been engendered by an opposite malady of the mind, credulity. This has generally been held to be the peculiar reproach of rude ages, and of the

vulgar and illiterate in more refined communities; but if we are to include under it, the hasty adoption of crude and fallacious theories, derived from real or pretended principles of science, it will be found, that in the history of physick, there is equal room for the imputation of credulity in the learned and cultivated ages, as in the rude and illiterate.

It seems evident from all this, that physick being an art beset with every species of fallacy, it is of the utmost importance that those who engage in it, should be fully aware of this, and that they should so discipline their minds, by a knowledge of the laws of evidence, and the rules of investigation, as not to fall into either of the extremes of credulity or scepticism, to both of which the human mind, in different circumstances, is so prone. And as we are to be guided more by experience than hypothesis, it is further manifest, that the rules for ascertaining and appreciating facts, and the study of the laws of evidence, ought to form an indispensable part of medical education. Nor let any one think that this is a matter of easy attainment; for Bacon himself, the great author and leader in the employment of inductive reasoning, was so far infected by the prejudices and errors of his predecessors and cotemporaries, as in various parts of his works to give humiliating proofs of childish credulity, in regard to certain super-

stitious and frivolous practices which then prevailed.

It is the author's intention, therefore, with unfeigned diffidence and humility, to endeavour to point out in what medical truth and error consist; what are the difficulties that have obstructed the progress of the art, and what the means of obviating them; in other words (if he may be allowed to adopt professional technology) to expound the physiology, pathology, and therapeutics of the medical mind, as the result of more than fifty years observation, experience, and meditation on these subjects.

SECTION I.

PRELLIMINARY DISCOURSE *on the General Laws and Principles of Animal Nature.—All Practical Faculties derived from our knowledge of the Physical Agencies of Mind and Matter.—These ascertainable only by Inductive Observation.—Constitution and operations of the Mind which refer to these.—Greater Difficulties in investigating Medical subjects than in any other branch of Nature.—This chiefly owing to the number and complication of the objects and agents which influence it, and mistaking the accidental and collateral connexions for those of cause and effect.—Enumeration and Exposition of the elementary attributes of Life, viz.—the Generative, the Conservative, Temperative, the Assimilative, the Formative, or Plastic, the Restorative, the Motive, the Sympathetick, and the Appetitive, in common to all living organic beings.—The Sensitive and Imitative, peculiar to sentient beings.—Incidental Remarks on Habit, Association, Instinct, Reason, Passion, &c.*

THE sound state of the mind in the exercise of the medical art, as in all the other practical pursuits of life, must consist in conceiving clearly and

correctly, the reciprocal relations of cause and effect; for as it is upon such knowledge alone, that the adaptation of means to ends, in which we have defined *art* to consist, can be founded, it is by the ascertained agencies of nature, and the just application of such as we can command, constituting skill and judgment, that the cure and relief of disease, are brought about.

These agencies are ascertained by observation and experiment: by the former, we may be said to listen to Nature, by the latter to interrogate her. The investigations belonging to the Philosophy of Mind are almost solely derived from observation: Those of the natural world, such as mechanics and chemistry, from experiment. There is one eminent exception, however, to this remark, for astronomy, though it belongs to the external material world, owes all its discoveries to observation, the object of it being too much out of the reach of human control to be the subject of experiment.

Every reflecting person must be struck with the admirable correspondence of the structure of the living body as a whole, and of the senses and functions in detail, in relation to external nature, such as the adaptation of the whole frame to the laws of gravitation, and of the eye and ear to the properties of light and air.

In looking still deeper, we perceive a like relation subsisting between the constitution of the mind and the laws of nature. The most essential attribute of these laws, is the *constancy* of their operation, as exemplified in the accuracy and precision of the revolution of the heavenly bodies, the unvaried, universal, and incessant action of gravitation, and every other circumstance, constituting what is meant by the course of nature in the inanimate world. Now, the constitution of the human mind has as evident a relation to this constancy of the laws of nature, as the senses have to their respective elements; for from the earliest period of life, there is, previous to all experience, a most unbounded confidence in the present and future constancy of events manifested not only in the instinctive actions, like those of irrational animals, but in the rational attainments in the practical life of man, as exemplified in those expectations and measures of prudence by which human actions, as well as those of mere animals, are guided and life sustained. This is exemplified in the latter, in the untaught propensities of new-born brutes, and in the human species by the belief that the sun will continue to rise every morning; that all bodies will continue unceasingly to gravitate towards the earth; that the human beings around us exist, feel, and think as we ourselves do; all which may be quoted as instances of this untaught knowledge, and as

proofs of final causes, as striking with regard to the constitution of mind, as the objects of sense with regard to the corporeal organs. And it is evident that unless both the mind and body were so constituted as to correspond with the constancy of nature, they could not make those faithful reports by the steadiness and uniformity of which all our actions and judgments are guided. And it is in this that the sound state of the mind consists; for false judgments and erroneous conduct must proceed from the want of a due correspondence between the reality of things, and the apprehension of them by the senses and the mind.

In tracing this still farther, we perceive that by virtue of this correspondence or co-ordinance of the frame of the mind with the established course of nature, there is in all the changes produced by the action of external bodies on each other, and on our own bodies, a rapid and instinctive connexion between cause and effect, manifested in that part of our constitution by which it is made susceptible of habit and association, and which is indispensable to our well-being, and even to our existence, particularly in early life. In fact, it is this ready perception of the connexion of cause and effect which constitutes the important faculty of observation in adult life. This may, literally, and without a figure of rhetorick, be termed the

mental organ, for it carries a reference to the constancy of nature, just as the eye does to the affections of light, and the ear to those of the air. Thus is every organ and function of the body, and every faculty of the mind, co-relative with, or represents and reflects, as it were, not only the *elements*, but the *laws* of universal nature * so that the sublime images and glories of the creation are displayed to our sensitive capacities as objects of grandeur and beauty, and to our intellectual capacities and enraptured minds as irresistible evidences of harmony and design.

To enquire, therefore, how or why the mind connects two events, frequently recurring in conjunction so as to expect the one when the other recurs, and why, or how, this connection should suggest the connection of cause or effect, is just such a question, as if any one was to ask how, or why, the *tunica cornea* of the eye is pellucid and not opaque, convex and not plain; the mind of man being as much adapted by the Divine Creator

* See this sentiment more fully illustrated in a Lecture on Muscular Motion, page 40, read before the Royal Society 1788, by Gilbert Blane, M. D. In the author's view of the subject, this is a fundamental principle in the investigation of the origin of our perceptions and judgments; but he has not met with it in any metaphysical writer except Madame de Stael, who, in treating of the German poetry, has ingeniously and appositely alluded to it in a passage in her work, intitled "De l'Allemagne."

to the laws of external nature, as are the organs of sense to their respective elements and objects, the affections of matter.

The final cause of all this cannot be mistaken; for if the rudiments of knowledge had not been

* It seems hardly necessary to state, that none of these perceptions can exist in the fœtal state, for want of the external impressions necessary to their existence. Even after birth, if all external excitements could be withheld as in the womb, no perceptions of sense, nor notions of the mind could arise. Does not this afford a simple solution of the question regarding innate ideas, which can only be viewed, like many other metaphysical and theological controversies, as a mass of sophistical verbiage, or at best, as a philological discussion on the import of words and the appropriate application of terms and epithets, upon which it is to be regretted that ingenious men have expended so much time and thought, and subjected themselves to so much exasperation of temper † as well as ridicule. It was objected to Locke, that if the existence of innate ideas were to be denied, there would be an end of all morality, inasmuch as the perceptions, notions, and judgments depending, in that case, on the contingent incidents of chance and education, would be arbitrary. No. For the Divine Creator, in the original frame of the human mind and body, has so adjusted them to each other and to external nature, that the dormant susceptibilities can be awakened only by those respective and specific objects previously ordained to excite them; and thus exemplifying that system of final causes adverted to in the text.

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† Stillingfleet, Bishop of Norwich, is said to have died of a broken heart, in consequence of the learned world having awarded the palm of victory to Mr. Locke, in the controversy of innate ideas.

thus rapidly, spontaneously, and intuitively acquired by that imitative power, which is one of the original and most essential faculties of nature, but had depended on the slow processes of induction, the ends of self-preservation, and the acquisition of language, could not have been effected. Moreover, these confident expectations of the future could never have been excited by reasonings *a priori*, inasmuch as we know nothing of the tie which connects cause and effect; nor could we ever have formed any anticipation of future events, but from the past experience of what may be termed simple *sequence*.* In a more mature stage of life, when reason comes to be developed, the same imitation of the processes of nature, and of the acts of our fellow-creatures continue, but

* This train of reasoning is taken from a Discourse read by the Author before a literary society at Edinburgh (The Speculative) in the year 1771, in which he endeavoured to refute Mr. Hume's doctrines, particularly that of custom being the only source of our ideas of cause and effect. And he has been in the habit of meditating on such subjects, during the course of a pretty long life, in the intervals of his active pursuits and duties. In the course of this discussion, the reader may possibly meet with some original remarks; but what they are, the Author himself cannot point ou Observations have occurred to him, which have seemed at the moment new to him, but which he found either to have been half-forgotten traces and obscure reminiscences of his own, or derived from the stores of others, particularly Bacon, Locke, Reid, but, above all, Professor Dugald Stewart, the most profound metaphysician, as well as one of the most elegant writers, of this age.

assume the form of deliberate purposes; and it is from discovering that the instinctive associations founded on the constitution of our nature coincide with rational experience, and therefore verified or tested, as it were, by reason, that we become assured of that actual existence and reciprocal influence of external bodies, by which we are enabled to exercise a power over Nature. For let it be granted that the intimations of the existence and attributes of matter are in the first instance merely illusions or arbitrary hypotheses; in short, mere sensations, proving nothing but the existence of a state of mind, the case comes to be altered when we find that all the suggestions of intuition are confirmed by the acts of reflexion, deliberately instituting purposes which are found to accord practically with the suggestions of instinct, and thereby dispelling all doubts that can be entertained, or pretended to be entertained, regarding the reality of external objects and their agencies.

Had this been well understood, would it not have afforded a sufficient refutation of the doctrine of Berkeley and Hume? And does it not supersede the various idle subtleties of some later writers on the subject of cause and effect. I repeat it: that Nature, or rather Providence, would in vain have so constituted our nature that by association, one event, sensation, or object should

suggest that which is inseparably connected with it, unless external nature had also by its reciprocal actions and affections, been so constituted as to correspond with them. This clearly establishes the differences between causation and mere connection, upon which Hume has raised his argument against the existence of a Deity.

An obvious and simple refutation of the same sceptical doctrines, might have been drawn from the consideration that unless there were in the universe more than one species of existence; no change, in other words, no event, could ever have happened, for every change or event must be generated by the congress of two active principles, which could not be the case were there no existence in nature but the human mind, as Berkeley and Hume allege.*

Some apology seems due to the reader, for detaining him with the refutation of a doctrine so extravagant as that of denying the existence of matter, which is a mere metaphysical juggle, or sophistical logomachy; for if such reasoning were to be tolerated, existence itself would be a word without a meaning; and, besides, the position carries the seeds of its own refutation within itself

* See this fully illustrated in the Lecture on Muscular Motion, reprinted in my Select Dissertations, p. 257.

on the principle of a *reductio ad absurdum;* for let any demonstration be apparently ever so clear, we are sure there is some flaw in it, if the conclusion involves an absurdity.

What I would allege in excuse for introducing this subject, and for entering so deeply into the analysis of the human mind is, that medicine embraces by far the widest range of knowledge of any of the liberal arts or sciences; and it is absolutely indispensable to every accomplished physician, deeply to study human nature, whether with a view to fix in his mind the laws of evidence and investigation, or to make himself master of the influence of the mind on health and disease: not to mention that a high order of literary and philosophick attainments is calculated to impress the world with that opinion of the dignity and estimation which is due to our profession.

In prosecuting this subject, therefore, it is to be remarked, that there is a great variety of knowledge in early life, and in the early and unlettered stages of society, which is forgotten in advanced life, and among more enlightened communities. As an example of the first, there may be adduced that judgment of distance and figure which we form by the eye, which never could have been acquired by mere vision, of which the only ob-

jects are colour.* But in consequence of locomotion, and of comparing the changes of shades and colours, as associated with distance and the properties of touch, the sight comes by a process of experience, though afterwards forgotten, to judge by association, of distances, and of the primary qualities of bodies, which are not the proper objects of that sense. This farther proves, that our real perception of external objects depends on the impression made by them on more than one of our senses. It seems clear that to any one possessing only a single sense, whether sight, hearing, or touch, no suspicion would arise of external existence. The only doubt is with regard to the sense of touch, and an eminent French metaphysician,† has alleged that our idea of external existence, arises from the mechanical resistance offered to the Will by touch. Neither the scope of this work nor its limits, will admit of of our indulging in any further discussion of this subtle subject.

An illustration of the imperceptible acquisition of knowledge, in the rude stages of society, may be drawn from the formation of speech, not merely in its vocabulary, but still more in its inflections and derivations. The various subdi-

* This observation was first made by Bishop Berkeley in a work of great ingenuity and acuteness intitled a New Theory of Vision.

† M. Destutt de Tracy.

visions and distinctions in the import of words, are founded on a most subtle and refined knowledge, or rather secret consciousness in exercising the faculties of the mind among mankind, before they have made any advances in literature, by a sort of instinctive conceptions, which are generally true to nature, and are so copious, that the learned find a sufficiency of ready formed words for most of their purposes, without having recourse to their own invention; and it requires such a deep research to analyse them, and to detect the germs of this primeval and untaught logick, that the words and phrases transmitted from rude and remote ages, can be retraced and unravelled only by the most acute and philosophical minds.

But we have still another remark to make, of the utmost practical importance regarding those early and unconscious associations which have been so much the object of consideration. The same physical constitution, which in infancy and very early youth, leads us instinctively to ascribe causation to the frequently connected events of nature, establishing our habits and associations, becomes, by the same process, the parent of error. For, as it is purely sequence, and not any idea of the intimate nature of efficiency upon which these early judgments are founded, the mere connection of events in time and place, frequently repeated, bear the same relation to the mind, and

operate upon it in the same manner as those that are founded on the laws of nature. And whether these connections are merely casual, or simple accompaniments, or collateral effects of the same common cause, they prove the greatest and most pernicious sources of error.

It is of the utmost importance, therefore, that these false and too often indissoluble associations should be detected, and guarded against, being the main engenderers of the most mischievous errors, and most inveterate prejudices, of those numberless fallacies, those nugatory and superstitious practices, with which the political, civil, and religious, as well as the medical world are infested, proving the most prolific source of that vice and misery which deform and imbitter human life and conduct.*

It is the main business of cultivated reason, that is, of genuine philosophy, to unravel (a literal tranlation of the Greek word to analyse) and tear asunder as it were, those fallacious and imaginary catenations of cause and effect, distinguishing them from those which are correctly referable to the physical and moral agencies of nature: in this consists the process of inductive reasoning, the

* See Dr. Johnson's Vision of Theodore, Hermit of Teneriffe, vol. xi. p. 145 of his works, edited by Sir J. Hawkins, the moral of which is to exhibit the evils of inveterate habits and associations.

only clue to useful truth and practical knowledge, above all, in medical researches, whether practical or theoretical, on account of the precarious and fluctuating circumstances under which the phenomena present themselves, and when truth cannot be elicited, and fallacies avoided but through varied and repeated observations.

In prosecuting researches into the several departments of nature, there is a great difference in the degrees of precision, in point of certainty and probability of which they are respectively susceptible; and of the degree of difficulty in obtaining satisfactory results. And with respect to physick, well might Hippocrates say, in the words of his leading aphorism *experimentum fallax, judicium difficile.* It is evident, that those departments in which the subjects of inquiry are most simple and invariable, will be the most easy of investigation, for they will be least embarrassed by complicated and collateral influences. Accordingly, of all the affections of matter which are the subject of experiment, those of chemistry admit of the greatest precision, for they consist of simple and steady affinities which determine the results without being complicated with other agents. This is so true, that a single experiment well instituted, is sufficient to establish a general principle.* In

* From this circumstance is probably derived the common phrase of *experimentum crucis,* to denote that sort of experiment

mechanics, on the contrary, there are a number of co-operating agencies, such as gravitation, cohesion, impact pressure and friction. Most of these taken single are so steady as to admit of computation, and even rigid calculation; but the difficulty of subjecting them to harmonious co-operation, is such as to render the results much less certain and satisfactory than those of chemistry. It is on this principle we can explain why the tides are less uncertain than the winds; the former depending only on solar and lunar gravitation, whereas the latter, beside this, are affected by the elastick property and more variable temperature and expansion of the air; also by electricity.

Animal life is not only by far the most complicated department of nature, but the most vague; for, besides being more or less subject to chemical and mechanical agencies, it possesses such a number of attributes peculiar to itself, and those of such a various and fluctuating nature, as to put their influences and combinations beyond the reach of all calculation; and so as to present the most formidable and discouraging obstacles to those

of which a single instance is conclusive. The crucible being the most important utensil in ordinary chemical operations, derives its name from the figure of the cross stamped upon it in the superstitious times of Alchymy, with a view to bespeak the divine favour in its processes.

who may propose, *a priori*, to predict or control its operations, whether in health or disease.

But it is incumbent on those who allege these causes of difficulty in physiological researches, to prove this by a correct enumeration of the principles peculiar to animal life, as distinguished from inanimate matter; and this seems to be the more necessary, that it has not hitherto, that I know, been undertaken by any physiologist. It is most manifest, that by no other method can any comprehensive system of theoretical physiology and pathology be constructed; and the accurate construction of such a system can alone prevent that abuse of theory which it is the object of this part of the present work to expose.

The author, therefore, feeling himself bound to exhibit an enumeration of what may be termed the elementary or cardinal principles which characterise living organic beings, as distinguished from inanimate matter, submits with due diffidence, the following scheme to the members of the scientific world, as well as to those of the medical profession. These organic beings consist of several classes distinguishable into the vegetable and animal, the animal divisible again into sentient and non-sentient, and the sentient into the rational and irrational. And it may be remarked, that all the properties of life belonging

to the lower classes, belong also to the higher classes, so that the ground of distinction is not founded on properties peculiar to each, but arises out of properties superadded to the higher classes. Those which belong to them all, therefore, fall first to be enumerated and consist of the following attributes, energies, faculties, or by whatever name they may be designated.

The Generative.
The Conservative, or Antiseptic.
The Temperative.
The Assimilative.
The Formative, or Plastic.
The Restorative.
The Motive.
The Appetitive.
The Sympathetick.

These are all common to animal and vegetable nature. There are two others which belong exclusively to animal and sentient nature.

The Sensitive.
The Imitative.

To that class of animated beings which are indued with a nervous system there is superadded the five senses, spontaneous or voluntary motion; and, in their train, the energies of association, habit, and instinct. These are in common to rational and irrational animals. The latter are

distinguished from the former by what is understood by reason, or the powers of intellect, including language, and by those qualities which consist in the moral sense, or the distinction of right and wrong constituting man an accountable being, and together with his intellectual qualities, forming an insuperable line of demarcation between him and the inferior animals.

With regard to what belongs to the intellectual and moral nature of man, it would be out of place to exhibit any analysis or enumeration of the faculties which relate to this subject. We are concerned with them in so far only as they influence life and health. This they certainly do incidentally, for life and health may, for instance, be materially affected by excessive intellectual labour; also by mental emotions, such as remorse, anger, fear, disappointment, and other exciting and depressing passions, all tending in various combinations with the corporeal causes above enumerated, to add to the complexity and difficulty of medical investigation as already observed.

After all, the author does by no means affect to deliver this enumeration and classification as perfect. On the contrary, he will have occasion, in the course of this work, to advert to the imperfection of it. And when we reflect that all these powers and principles operate on each other in a

circle, and also through innumerable collateral and mutual influences, it seems doubtful whether they will admit of any arrangement which, in point of importance of rank, and correctness of method, would be found satisfactory and free from objection. The only thing required, and all that is aimed at here, is, that this statement shall be as complete as possible in point of enumeration, being meant to comprehend all the elements of health and therefore of disease; the alphabet, as it were, whereby to express and expound, by innumerable combinations, the sound and morbid phenomena of the human body. For, unless the whole powers belonging to, or affecting animal life are enumerated, there must somewhere be a correspondent blank or omission in accounting for the phenomena and in making a rational application of them to practice. Since every disease consists in the derangement of one or more functions, there can be no clear nor satisfactory explanation of morbid affections without a complete and comprehensive knowledge of those which exist in the sound state. The object of the author is not to bring forward any favourite speculation or theory of his own, but to enunciate a descriptive and analytical statement of the facts which belong to the natural history of life, health, and disease, as the foundation of studies and doctrines indispensable to every professional candidate who wishes to see his way clearly through the labyrinths and difficulties he has to encounter,

and to avoid being bewildered by those embarrassments and perplexities to which he would otherwise be exposed in the practice of his duties.

We now proceed to deliver a definition and brief comment on each of the principles in the preceding list which have been stated as the distinctive characters of living organick nature.

I.—*The Generative Principle.*

It will not be disputed, that this primary energy of nature belongs purely and peculiarly to animal and vegetable life. Being emphatically named the mystery of nature, and being now admitted, by all correct physiologists, to be inexplicable, it requires in this place, merely to be enunciated. It may not, however, be without use, here, to hold out as a beacon to those who may still be disposed to waste their time and labour, in attempting to overleap the insuperable boundaries of nature, the fruitless and absurd results at which they are likely to arrive. What, for instance, can be so extravagant and irrational, as that hypothesis, which professes to explain generation, by supposing an infinite involution of embryos? *Obscura obscurioribus.* The doctrine of that most respectable physiologist, Dr. Blumenbach, who refers generation and growth to what he calls the *formative nisus*, is perfectly consonant to reason; inasmuch as it

is to be considered rather as an exposition of facts, than as a theory.*

In attempting to reason upon, or to account for the most plain and familiar *phenomena* in this branch of animal nature, we find ourselves immediately at a stand. What, for example, can be more inexplicable than the equality, or rather the near equality of the sexes, for there is a small majority in favour of males. Hufeland, a German Physician and Naturalist, has been at great pains to collect the relative numbers of the two sexes in all parts of the world, and has found them every where the same.† It seems still more singular, and at the same time most admirable in the institutions of nature, that this relative number of the sexes should be maintained, though the primordial germs are mixed in different proportions in the *ovaria* of different females; for it is well known that many females produce such a number of children in succession of the same sex, as is utterly irreconciliable with the laws of blind chance, another word for mathematical necessity. This might be more familiarly illustrated by stating, that the succession of the births of the

* See D. I. F. Blumenbach, Abhandlung über die Nutritionskraft. St. Petersburgh, 1780; and de Nisu Formativo. Gottingen, 1787.

† See Journal des Pratische Heilkunst, January 1, 1820, Berlin. The proportion is that of 21 males to 20 females.

two sexes does not follow the rule which takes place in drawing a lottery. When, for instance, an equal number of black and white balls are shaken together in the same bag or box, it would be contrary to the laws of chance (for chance is subject to mathematical laws) that six, eight, or ten, or more of the same colour, can be drawn successively, as we not unfrequently witness with regard to children of the same sex in particular families. The final cause of the small plurality of males seems to be, that more male children are still born or die in infancy than females,* so that at the age of 14, both sexes are equal. What commands attention in this is, that, notwithstanding, this inequality and irregularity in the procreative function of individuals, the relative numbers of the sexes is maintained with the greatest and most universal exactness with regard to the whole species. Not only the great curiosity but deep importance of this fact, seems hitherto to have escaped the notice of physiologists, philosophers, and theologians. Does it not prove that the arrangements of nature are utterly irreconcileable with atheism, whether absolute, or that form of it called naturalism, that is, the identification of the Deity with the material world and its laws, imputed to Spinoza? For it must be

* The most probable conjecture regarding the cause of this is the greater struggle in the parturition of males, on account of their superior size to females.

obvious to every reflecting person, that what has been just stated, cannot be accounted for without admitting the existence of DESIGN, an attribute which can only be predicated of that conscious intelligence which constitutes *mind*. Innumerable problems in this and every other department of nature might be stated equally unsolvable on any other principle,* equally impenetrable to finite understandings, equally commanding our admiration and devotion, being equally demonstrative of the existence of a supreme contriver.

The morbid deviations of the generative energy, consisting in mal-conformations, monstrosities, extra-uterine, and abdominal † fœtations, can hardly be regarded as objects of practice. It may merely be remarked that the health, as well as the happiness, virtue, and dignity of the parent, and the perfection of the offspring will best be consulted by the purity of life implied in the temperate exercise of this faculty.

II.—*The Conservative Principle.*

BY this is meant that power by which the living body is prevented from running into putrefaction,

* See a remark illustrative of the same principle in the Edinburgh Review of 1807, Vol. XI. in the article Mécanique Céleste, well known to have been written by that accomplished mathematician, philosopher, scholar, and gentleman, my friend, the late Professor Playfair, of Edinburgh.

† See Med. Chirurg. Tr. Vol. viii. Article 8.

and may therefore with propriety be called the *antiseptick* principle. According to the experiments of Dr. Alexander,* the range of temperature most favourable to the putrefaction of dead animal matter, being between 86° and 100° Fahrenheit, includes the usual standard of human heat. There must, therefore, be some powerful energy in life itself, which counteracts this tendency to spontaneous decomposition. It was alleged by Dr. Alexander, and some of the other physiologists of that day, that putrefaction is averted by constant motion of the fluids and solids during life, together with perpetual removal of effete matter, and the fresh supplies from food. These are evidently quite inadequate to account for this striking phenomenon; and that there is an antiseptic power in life independent of motion, and of the change of matter, is proved, by the same principle of self-preservation being found in the quiescent state; for instance, in impregnated eggs and in animals in their torpid state of hibernation, also in the juices of trees in winter. This subject was first set in that clear and interesting view which is due to it, by Mr. John Hunter.† These discoveries are rare and valuable specimens of true inductive research; and for logical pre-

* See Experimental Inquiry on the Causes of Putrid Diseases, London, 1771.

† See Observations on Certain Parts of the Animal Economy, Lond. 1786. Also Treatise on the Blood, Lond. 1794.

cision and vigorous originality of mind have never been surpassed, nor perhaps equalled, in the history of physiology; and it is not easy to be accounted for, that in the present times, neither the import of his doctrines is clearly understood, nor their importance duly appreciated. We meet with works on physiology, some of them even professing to be complete systems, in which this fundamental law of life is not once adverted to! The like remark may be made regarding those publick Lectures, printed or oral, which profess to deliver the theory and description of diseases. It pervades also the living organic bodies of a lower order, as is manifest in vegetable substances, which though not endowed with the same degree of heat as animals, are yet in such a state of succulence, as would lead to immediate destruction, unless they were sustained by this principle. This conservative principle was considered by Mr. Hunter as so important an element in the existence of all organized beings, that he deemed it the most essential constituent of what he called emphatically, the *Living Principle.* It maintains a constant and arduous struggle against the septic tendency incident to the matter in which it is inherent, and it is more or less equal to this struggle, according to the constitution of individuals, and the operation of morbid causes. It seems, indeed, to be the principal circumstance, by which the com-

parative degree of vital vigour in individuals ought to be estimated.

The circumstances in which it shews itself in a state too low to maintain life, are in those local affections in which gangrene takes place, and in those affections of the system in which the whole constitution sinks under them, as in acute disorders, generally produced by a morbid poison, such as small pox, typhous fever, and plague. The propriety of calling these disorders putrid has been questioned, because they do not produce actual putridity before death. This is certainly true, for actual putridity is incompatible with life; but the rapidity with which the dead bodies of those who perish by those disorders rush into putrefaction, is so much greater than that of those in whom life had been extinguished by other diseases, or by external injury, that there can be no doubt, that the conservative principle had been maintaining, before death, an unequal combat with the principle of spontaneous decomposition. The flaccidity of the muscular fibres, and the fluidity of the blood after death, are also indications of impaired or lost vigour in this principle: and these circumstances are observable in the bodies of those who die of certain diseases, such as infectious fever, or of certain poisons, such as that of the serpent *seps* (so called from the sudden putrefac-

tion after death of the subjects to which its venom proves fatal) : that of hydrophobia ; * also in the case of some kinds of violent deaths, as from a blow on the stomach,† or from lightning. It is farther observable in such cases that the muscles are in a state of flaccidity, and that the blood does not coagulate, a proof among others that coagulation is a vital action. And in all such cases putrefaction is observed to come on earlier than where no such circumstances have taken place. This principle is very strong in the blood, for if the flow of it into any member is obstructed, mechanically or otherwise, gangrene ensues, as is exemplified in the case of the ligature, or compression of the great arteries of the extremities, and also when the circulation is stopped by extreme cold. In consequence of the different degrees with which individual constitutions are gifted with this principle, they are more or less obnoxious to the several causes of dissolution, and more or less capable of resisting them. Life seems sometimes even to sink under this latent infirmity, without any other adequate cause, as I have known in the case of some slight indispositions, in which sudden death took place, in circumstances which appeared unaccountable,

* See a remarkable case in the Archiv. der Heilkunde of Berlin.

† See John Hunter, loco jam citato.

but which seemed to be explained by the subsequent rapid putrefaction of the whole body.

As there is a comparative deficiency of this conservative energy in some constitutions, so is there an exuberance of it in others. The proofs of this consist in the resistance which some individuals oppose to the causes of gangrene and to putrid fevers, either by maintaining an exemption from them, or by restoring themselves more readily than others, when under their action. The superior prevalence of this principle is probably also one of the main causes of the longevity of some individuals.

The difference in the vigour and duration of this principle in different individuals, depends most essentially on the primordial *stamina*, but somewhat also on the habits of life. The spontaneous local gangrenes in extreme old age, particularly in the lower extremities, is an indication of a decay of this principle from time alone. And we may here take occasion to remark, that the various forms in which dissolution approaches, are owing to the relative vigour of the different principles on which life depends. In a subject, for instance, in whom there is an incurable disorganization of the lungs or any other vital part, the struggle will be longer or shorter, according to the power of this conservative principle; or of the

digestive, which maintains life against the decayed state of the vital organs; and the cause of one individual suffering longer, or more intensely, than another in the extremity of life, is owing to one constituent of life being more vivacious than another, which prevents, as it were, the springs and wheels of life from running down in concert. Easy death, or *euthanasia*, therefore, consists in the simultaneous extinction of these energies.

III.—*On the Temperative Principle.*

By this is meant the heat with which all living organic bodies, whether sentient or non-sentient, are endowed, and has been called by physiologists, the Generating Power of Heat.

It would be out of place here to enter into any disquisition on the general nature of heat. The question relating to its materiality, is, perhaps, too subtle ever to admit of a solution. It is sufficient to say, that, when we consider its property of expanding all bodies, of diminishing the cohesion of all solid matter, of its bringing solid substances into a state of fusion, and liquid substances into a state of elastic fluid, it may be pronounced that its essence consists in diminishing the attraction, or adding to the repulsion, of the ultimate particles of matter; and when to this we

add its tendency to equilibrium in all inanimate bodies, its passing to or from a latent or sensible state, in the passage of bodies from one form to another, and that different bodies possess different capacities for it; also that all its known sources are the solar rays, chemical and mechanical action, and (as I hope to prove) vital action, all the influences of it on the material world, are, I believe, enumerated.

But, waving the consideration of all these, except the last, our business here is to advert to those laws of animal temperature which distinguish it from those of inanimate matter.

1st. The temperature of most living animals is considerably higher than that of the medium in which it is immersed, whether air or water, and therefore higher than the like mass of inanimate matter, in the same circumstances, for this would immediately conform itself to the equilibrium of that medium, which is in contact with it. This is remarkably so in man, in common with other animals of warm blood; for the natural temperature of the human body is 98° Fahr. a degree rarely occurring in the atmosphere even of the warmest climate, and far above the average heat of the hottest spot on the globe.

2dly. The great uniformity of heat at all times and in all circumstances, in the healthy state of every individual of the same species of animal. This has been ascertained by innumerable experiments on persons of all ages and sexes,* and forms an exception, with regard to most other points in the animal constitution of man. For while there is a great variety in the stature, features, and forms of individuals, also in the habitual frequency of their pulse, their degrees of muscular strength, sensibility, susceptibility, appetites, &c. there is a steady uniformity in their standard of temperature. Let it be understood, however, that this applies only to the actual temperature, for it appears from the diversity of susceptibility to heat and cold, in different individuals, that the generating principle, itself, is various both in vigour and excitability in different persons, and in the same person at different times. All this affords a strong presumption, that animal temperature is generated and regulated by vital action, and that (as I hope to evince by what follows) its combination with the conservative principle, forms the main constituent of simple life.

Of the experimental proofs of the first of these

* This observation was first made by Mr. Martin, among other original and important facts, in his ingenious work on Thermometers.

positions, namely, the resistance to the law of equilibrium, the following may be enumerated as some of the most remarkable and original. Mr. Ellis, Governor of Georgia, in North America, has recorded in Phil. Trans. of the year 1760, that while the atmospherical heat was considerably above 98°, the human body continued at this its usual standard. In an elaborate and well conducted experiment on a heated room, projected chiefly by Dr. G. Fordyce and Dr. Blagden, in the year 1775, and related by the latter in the Phil. Trans. it appeared that the human body retained its natural standard under an external heat of from 111 to 112. The same principle is amply illustrated by Mr. Hunter, in an article in the Phil. Trans. of the same year; and in a work entitled, "Observations on certain parts of the Animal Economy," in 1786. He there proves that, even in animals of cold blood, such as fishes, whose temperature approaches to that of the ambient medium, strong resistance is made to the communication of heat and cold, such as takes place in inanimate bodies. In giving an account of this important discovery, the name of Dr. Cullen ought by no means to be omitted. He was the immediate predecessor of Dr. Black in the chemical chair both of Glasgow and Edinburgh; and there can be little doubt that his very striking experiment of freezing water by the eva-

poration of æther under an air pump, as long ago as the year 1755,* in illustration of his doctrines publicly taught before that time, had its influence in directing further researches of the latter, which contributed so deservedly to his reputation. It was Dr. Cullen, also, who first broached the question regarding the power of the living body to produce heat and cold.† The inference from the whole of these observations and experiments has been, that there exists in the fundamental operations of life, a power of generating and repressing heat,‡ quite at variance with the affections of inanimate matter.

The principle in question may be farther illus-

* See Physical and Literary Essays of Edinb.

† See this fully proved in an inaugural Dissertation, by his son Archibald Cullen, in the year 1780.

‡ There are experiments of Boerhaave not unlike some of those that have been mentioned, and tending to the same conclusion. He confined a dog in an apartment raised and kept up to the temperature of 146 Fahr. After a lapse of some hours, the animal died, and a thermometer being introduced into the mouth stood at 110. But the reflection that the powers of life had prevented the equilibrium of heat from taking place, did not occur to the mind of Boerhaave, for his favourite principle was to account for physiological phenomena by chemical or mechanical agencies. This is exactly what occurred in the experiment of Fordyce and Blagden; and it falls here to be remarked, that those who continue so pertinaciously to advo-

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trated and confirmed by what takes place in small animals. The small birds of the order *passeres* * are possessed of a degree of natural heat superior to that of man. Can any one who considers how immeasurably greater the abstracting power of heat is in these diminutive animals than in the human subject, the ratio of their surface being as the square of their mass, believe that this can be accounted for on chemical principles, though their pulmonary system is more extensive than that of the *mammalia?* This is farther strengthened by the case of insects. Let the bulb of a thermometer be thrust into a hive of bees, it will rise to 97 or 98; the heat of the healthy human body: and when it is considered in what a close habitation these insects live, it is quite inconceivable that there should be an extrication of heat sufficient to beget this degree of temperature, without producing suffocation.

Is it not also a strong presumption of the vital origin of heat, that its uniformity is kept up, not only as has been stated, in spite of the fluctuations

cate the sufficiency of chemical causes to account for the heat evolved by animals and vegetables, are equally bound to account, on their principles, for the production of cold, which, as far as I know, they have not attempted to do, even by conjecture.

* Zimmermann observes that the heat of birds is 111° Fahr. and this is confirmed by other accurate observers.

of the surrounding medium, but in spite of the fluctuating operations of those functions which the partizans of chemical action allege to be the sources of heat; namely, digestion, secretion, and respiration.

The main arguments, in favour of the chemical origin of heat, rest on the interesting modern discoveries in chemistry, particularly regarding oxygen, its various properties and its habitudes with other bodies, in the phenomena of respiration and combustion. It is alleged with great plausibility, that as the temperature of the various classes of animals bears a proportion to the extent and perfection of the respiratory apparatus of organs with which they are respectively provided by nature, as exemplified in the gradation of mammalia, amphibia, and fishes, it is highly presumable that this part of their structure must have some connexion with their corresponding gradations of temperature. In answer to this, it may be alleged, 1st. That if animal heat depended on respiration, it would be encreased by an increase of the frequency and depth of respiration. This can be decided by an experiment which any one, at any time, can perform, by the incitement of the will. But in all the trials made by myself and others, I never could perceive that any encrease of heat could be excited by it, as would in-

fallibly be the case were the hypothesis true; for the frequency of respiration would act on the lungs, just as the accelerated action of bellows acts on bodies in combustion. 2dly, These theorists allege that the increase of heat in chemical combinations arises from the sensible heat evolved in the act of oxygen combining with carbon, the former of these having a much greater capacity for heat separately than when combined with other bodies. But Sir Humphry Davy has clearly demonstrated that the heat created by chemical combination, or otherwise, cannot be so accounted for;* but that it depends on the intense action of the ultimate particles of matter on each other, in the act of combination or decomposition, under the influence of radiant matter.

3dly, Though the author is aware that, conformably to the ascertained principles of the chemistry of inanimate matter, there ought to be a conversion of latent heat into sensible, or thermometrical heat, by the combination of oxygen with carbon, in the act of combustion, he infers from the above-mentioned consideration, that this is

* He says at p. 49 of his Elements of Chemical Philosophy, "Vivid inflammation occurs in a number of cases in which gaseous matter is not fixed, and this phenomenon happens in various instances without the interference of free or uncombined oxygen."

entirely inadequate to the production and maintenance of that high temperature and equally diffused heat in animals of warm blood. The focus of this heat, which, as stated by the partisans of the chemical origin of animal heat, would be confined in a state of insufferable intensity to the bronchia and trachea, and will not account for what perpetually exists in the whole trunk and extremities of the body, far less for the generally increased heat in fever and that of local inflammation. Besides, several of the facts assumed by Dr. Crawford and other favourers of this doctrine, have been disproved. It is alleged by that author, that the specific heat of venous and arterial blood is different. But this has been experimentally disproved by Dr. John Davy, who alleges farther, on the suggestion of his brother, Sir Humphry Davy, that the greater heat of the heart and lungs seems merely owing to their being the most central part of the body, and abounding most in the principle of vital action, and he has occasionally found the heat of the stomach higher than that of the heart. In these arguments, it may be added, that if this theory were founded in nature, the heat of the body ought to be diminished by the diminished energy of the pulmonic organs. But it is well ascertained that, in the advanced stages of *phthisis*

* See Phil. Trans. v. 114.

pulmonalis, when two thirds of the lungs have their functions destroyed, the animal heat is never so high, the patient lamentably complaining of it, as if he were on fire.

It may be asked, what then becomes of the sensible heat evolved by the combination of the oxygen with the carbon? I answer, that it may, without prejudice to the generating power, be admitted to contribute something to the heat of the parts in its immediate vicinity; but sooner than admit that so great an effect as the amount of the whole heat of the whole body, could be produced by so inadequate a cause, I would believe that the heat thus produced is quenched by a vital action, similar to that which maintains the equality of animal temperature, in opposition to the law of equilibrium in inanimate matter: and the fact, that the strongest voluntary breathing has no sensible effect in raising the temperature, lends some countenance to this conjecture. And if it should be farther asked, whether the operation of oxygen is not that of creating heat, what end does it answer in the animal economy? For its presence is found essentially necessary to the vital existence of all organic nature. I answer, that the importance of the part it here acts, consists in its being an indispensable stimulus to life; as is proved by the necessity of it to the existence of

all animals, from the highest to the lowest in the scale of being; and the quantity requisite for sustaining the life of fishes is so small, that it cannot be considered as contributing to this by the quantity of matter which it supplies, whether for nourishment or chemical agency: and this holds still more with regard to the class *Vermes*, where mere contact seems sufficient.* But whoever will call to mind the very important and original experiments of Priestley, will perceive that not even contact, in the ordinary sense of that word, is necessary. This great philosopher (who, by this discovery in physiology, ought perhaps to rank next to Harvey, Pecquet, Bartholine and the two Hunters) was the first to ascertain the influence of oxygen upon life; and in one of his experiments, in which he discovered that the scarlet colour of the blood was produced by it, he found that this effect was produced through the membranes of the bladder which contained the blood.

If it were necessary to adduce any farther arguments for the elucidation of this question, it might be alleged, that one of the purposes of respiration is to cool the thoracic *viscera*, by fanning them. For the proof of this, it is only necessary to state that, by the wise arrangement of Provi-

* See an article in Phil. Trans. 1824, by Sir Everard Home.

dence, the temperature of the atmosphere is every where considerably lower than the natural standard of heat in animals of warm blood; and to appeal to popular experience in evidence of the great superiority of cool air over hot, for the purpose of refreshment, when the body is overheated by the excitement of excessive exercise, or any other cause.

In favour of the doctrine of heat being an original, essential, and inherent constituent of life, in all its forms, its uniformity and its resistance to the law of equilibrium, particularly in extinguishing external heat, also the inefficacy of respiration accelerated by volition, in raising the animal temperature, and the high temperature of minute animals, have already been stated as presumptive proof. I shall now adduce some positive facts and observations, as direct proofs of it.

The body after death, from whatever cause, is considerably longer in falling to the temperature of the surrounding medium than the like mass of inanimate matter. This is most remarkable in the case of violent death particularly where there has been little or no effusion of blood, the powers of life being in such circumstances more vigorous than when they are reduced by disease. It has also been observed that, in cases of sudden death from apoplexy,

there is a much greater prolongation of heat than in cases of death from other diseases, as might naturally be expected, from its resemblance to violent death. The cases of this kind which have been most accurately recorded, are those related by Dr. Portal, who has remarked that the heat, for some time after death, was even higher than the natural standard. It has also been stated as an incontrovertible truth, by Dr. Badenoch, in his work on the diseases of India, that, in cases of death from exposure to the sun, called insolation, or *coup de soleil*, the body retains its heat after death for a considerable time; and that it rose even higher than the standard of life and health. In one case from 5 to 6 degrees at the end of twenty hours. In all these cases there must exist an unextinguished generation of heat, dependant on inherent vital action, and evidently independant of respiration, and the probable cause of its rising above the standard, was the want of the cooling power of respired air.

With regard to the other hypothetical causes of animal heat, such as fermentation, assimilation, friction, and the motion of the blood, they are so obsolete and inadmissible as not to deserve notice, were it not that M. Despretz, in an experimental research which has certainly the merit of great industry and ingenuity, though fallacious in its result; and which gained the prize of the Academy

of Science, has alleged in his conclusion, that, though respiration will not account for the whole amount of animal heat, the rest may be accounted for by assimilation, the motion of the blood, and friction. It is difficult to understand how an author so enlightened, should not know that the motion of liquids does not produce heat, and that it is produced by the friction only of dry bodies against each other.

But, admitting that animal heat cannot be accounted for by chemical agency, there still remains another question belonging to this subject. Is it an attribute of simple life, or does it originate in the energies of the nervous system? Mr. Brodie has, in a very ingenious and well instituted series of experiments,* proved that the generation of heat is greatly influenced by nervous power: but he subjoins to his conclusions, in the true spirit of philosophical reserve, that he cannot decide whether this effect takes place by the collateral *influence*, or by the direct *agency* of that power. This is a most important distinction; and it would have been well if it had been duly attended to by other experimentalists, who, by overlooking it, have been led into many hasty and erroneous inferences. I have already alleged, with regard to the point in question, that the generation

* See Phil. Trans. vol. 102, p. 378.

of heat is an essential constituent of simple life; from which it follows, that the effects produced by other causes, whether nervous power, mechanical and chemical impressions, Galvanic stimulus, or mental emotions, are matter of indirect influence and not of immediate agency. It has been sufficiently proved by the experiments of Baron Haller, that the heart can act after the removal of all nervous and sensorial influence; that such influence is only occasional, in virtue of the reciprocal consent of every part with every other part indispensable for the purposes of the animal economy. This may be exemplified to the satisfaction even of the most unlearned, by appealing to their experience on the occasional and accidental influence of the passions on the action of the heart. The same reasoning applies to the generation of heat. But there is a still more direct and unanswerable proof of this in the resistance, not only of animals without brain and nerve, but of living vegetables, to the equilibrium of temperature. All this has been made out in the most satisfactory manner by Mr. Hunter.* He has proved that this life of vegetables belongs even to their fluids; for they resist the cold which freezes other fluids, and when deprived of life by the intensity and long continuance of a low temperature, their life is extinguished and they freeze with a loud report

* See Phil. Trans. Vol. 65.

from the expansion taking place in their transition to a solid form. There is a curious proof of the production of heat by vegetation, in the American Philosophical Register of 1814. It is there recorded by Dr. Brown, of Lexington, that the roots of wheat having shot into ice, thawed it. Is not the heat generated by malt, when under germination, to be accounted for on the same principle? Mr. Lamarck, a French botanist, has observed that the parts of generation of the *Arum Italicum* have a strong sensible heat at a particular stage of their growth; and Mr. Bory de St. Vincent has also affirmed that the *spadices* of the *Arum Cordifolium* exhale a very sensible heat during their fecundation. The flowers of some species of plants, such as the Calendula, give out not only sensible heat, but light.

The argument adduced by the advocates for chemical causes, deduced from the decomposition taking place under germination, will not apply to these facts. And the author cannot help again remarking how singular it is, that these partisans should not feel themselves bound to account for the generation of cold as well as of heat. Without this, their disquisitions seem to be labour in vain, if their object be to prove that temperature is not affected by the vital processes.

The author has deemed it necessary to enter thus fully into the arguments on both sides of

this question, in order to justify himself in inserting the temperative energy in the list of the powers peculiar to life, essentially, fundamentally, and originally inherent in every form and degree of vital existence, whether animal or vegetable, solid or fluid, independently either of chemical, nervous, or sensorial agency: or if he may be permitted to express himself mythologically, he would say that life was kindled in the nascent embryo at the instant of conception, by a Promethean spark, which glows with more or less fervency, but without intermission, till its extinction at the last moment of vital existence. This doctrine he considers as fully established by a legitimate induction of facts, and ventures to predict that, in the next century, the doctrine of chemical agency being the exclusive or main cause of animal heat, will be as much exploded as the mechanical theories of Pitcairn, and the chemical theories of Boerhaave, broached in the last century, to account for vital actions, are exploded in the present age*.

I shall conclude with a few further reflexions on

* There are two works which I regret not to have seen till after this part of my own work went to press: Mr. Ellis's Enquiry, and Mr. Abernethy's Lectures. I cannot but respect the former for the great depth and precision of his chemical science, though I differ from him on the result; and I highly honour the latter for his able exposition, and due appreciation of the labours of Mr. Hunter.

this subject, particularly as applicable to practical medicine.

As the heat of the human body is higher than that of the atmosphere in almost every season and climate, the generating power, in order to maintain its equable pitch, must be in perpetual requisition; and must also be excitable in various degrees, in order to supply what is carried off by the fluctuating temperature of the external air; and it must also be so regulated as to accommodate itself to that portion of heat which is artificially retained by the varying quantity and quality of clothing. The exertions required of this animal energy being therefore a main element of health and disease, of enjoyment and suffering, it is highly important, practically as well as physiologically, to consider the play which takes place between the generating power of heat and the different degrees of external temperature, applied to the skin and lungs, whereby this generating power is variously excited or repressed, our living frame being so constituted as to require an external temperature, considerably below its own standard heat. In this, though there is a range of many degrees compatible with life and health, there is one point which is found the most agreeable and salutary. This is found to be about the 62d degree of Fahr. in our temperate climate, but higher, no doubt, in constitutions calculated for

the torrid zone, and lower in those calculated for the frigid zone.*

This is a view of the subject which has not hitherto engaged much of the attention of physiologists, pathologists, or practitioners. It is deducible from it, that there is a particular point, or small range of atmospherical temperature, at which the generating power is excited to that pitch at which it may be said to be at its maximum, producing the greatest measure of health, pleasure, alacrity, and vigour, all which are counteracted either when the exciting power is too much repressed by the close approach of the external heat, or too much required of it by the external temperature falling much below the salutary degree.

On this principle† I would account for the feelings of languor and depression which the inha-

* It has been observed by those who have navigated the arctic latitudes that when the atmospheric temperature falls very low, even from 30° to 40° below zero, the feeling of cold is not proportionally distressing. This is on the authority of Capt. Parry, who, in his narrative of his first expedition to the Polar Seas, imputes it to the stillness of the air, which generally prevails there. When there happened to be a breeze preventing the air in contact with the body from gathering warmth, the sensation of cold became intolerable.

† I hope I have here expressed myself so clearly as not to be misunderstood; for the German translator of a former edition of this work, for want of duly comprehending this passage, quite perverted its meaning.

bitants of temperate and cold climates experience on their first arrival in a tropical climate. This is popularly and vaguely said to proceed from *relaxation;* a term borrowed from inanimate subjects, and, in this sense, not very intelligible as applied to life. The excess, defect, and salutary medium depend on the presence and absence and varying degree of actual excitement; a view of the subject which seems conformable to the system of Dr. John Brown. According to this system, what is called direct debility consists in the want of actual excitement, the excitability remaining unimpaired, but morbidly accumulating. In my apprehension, therefore, these feelings proceed from the excitement of the generating power being repressed by a greater degree of external heat than that to which it had been habituated, and under which the alacrity and vigour of the mind and body had been sustained. And, in case of the stronger application of heat, as in the case of scalds and burns, the like explanation applies, for the generating power being overwhelmed, the vital energy is nearly destroyed: so that the best practice is found to be the restoration of action by strong external *stimulus,* such as alkohol or oil of turpentine, before that re-action supervenes which requires bleeding, and other antiphlogistic means.

The morbid excess in the generating power of

heat is chiefly exemplified in the system, by this being one of the most prominent characters of fever, and from which the name of fever is derived in all languages; and in local affections, by the cognate term inflammation. The highest degree to which the heat rises in fever is 110° or 112°. It has been alleged that morbid temperature can be carried even to combustion. Narratives of such cases occur not unfrequently in the annals of medicine, and Plouquet* enumerates twenty-eight of them. The far greater number of these cases have been aged females addicted to intoxication by means of spirituous liquors. I believe none of them have been witnessed in the act of combustion, so that doubts still remain whether they have not been caused by accident. There is a recent case recorded in the Medical and Surgical Journal of Edinburgh, † strongly in proof of the reality of such accidents.

On the other hand, when the external temperature falls within certain limits below the salutary point an invigorating effect is produced, for the generating power is roused in the healthy subject, as is evinced by the ruddiness of the face and an encrease of the force of pulsation of the

* See his Literatura Medica, Article Combustion; Tubingen, 1808.

† For 1823. Page 653. The subject was a male. It argues rather great combustibility than combustion actually spontaneous.

arteries, with a greater alertness and vigor of the voluntary muscles. In case of syncope, also, or the approach of it, one of the best momentary means of restoration is to dash cold water in the face or hands. These remarks do not apply to weak and exhausted subjects, for in these such applications would have the opposite effect. The cold may be so great, that the generating power may not be able to supply the warmth requisite for the support of life, even in the most vigorous subjects, so that death ensues, if carried beyond a certain point.

The like principles are applicable in our practical judgments, with regard to the administration of the cold and warm bath, and of fomentations.

From the obvious effect of external cold, in causing catarrh, pulmonic inflammation, rheumatism, and even continued fever in predisposed constitutions, there is a strong popular prejudice against the medicinal application of it, and a strong prepossession among the vulgar in favour of heat, as exemplified so prejudicially in the ancient treatment of small pox, and other disorders. One of the most eminent improvements in modern physic and surgery is, that of having surmounted this prejudice; and it is now freely and boldy employed in complaints both general and local. Dr. Currie remarks justly, that a high degree of morbid heat cannot fail to aggravate the disorder in which

it exists, by its noxious *stimulus*, and that it ought to be abstracted by the application of cold water to the surface of the body. In following out this, however, a nice exercise of judgment is required in the selection of cases, and the mode of administration; for, when the powers of life are strong, as in the case of active inflammation, whether general or local, the application of cold may, by re-action, excite the generating power of heat to excess; and when they are very languid, it may produce such a chill as to run the risk of extinguishing arterial action, or of causing a determination on some vital part.*

I shall conclude these reflections with observing that it is matter of much surprise that this principle, which I have named Temperative, should have met with so little notice from those who have applied their minds to the philosophical researches of animated nature. I have made the like remark with regard to the Conservative principle. In the view which has been taken of these two principles, I have ventured to state them as the constituents or bases of simple life, as existing separately from sentient life; the other principles

* This is well expressed by Cicero, in one of his rhetorical similes.—"Ut sæpe homines ægri morbo gravi cum æstu febrique jactantur, si aquam frigidam biberint primo relevari videntur, deinde multo gravius et vehementius affectantur." Orat. I. in Catil. This may be received as a proof of the professional, or at least the popular opinion on this point of practice, among the ancient Romans.

which have been enumerated, being rather the functions subservient to life, than its constituents.

The system of the once celebrated Dr. John Brown seems to have been taken up on some dark view of this doctrine imperfectly understood and erroneously applied. What he calls *direct debility* is analogous to what has here been called the repressed generating power of heat. He conceived life itself to consist in actual excitement; and not in excitability, though perfect, but dormant, and morbidly accumulating. But his doctrines led to such destructive practice, that they are now generally and deservedly exploded. The mathematical form of demonstration called a *reductio ad absurdum*, may be legitimately employed against it; for, whatever arguments or assumptions terminate in a conclusion which is false in fact, we may rest assured that they are themselves false; and as it is false in fact that depletory remedies are almost in every case, that is, in ninety seven cases out of one hundred, according to Brown's calculation, pernicious, and that stimulating remedies are almost in every case salutary, insomuch that it has been proposed by some of his partizans to destroy lancets and throw away all purgative medicines, no further refutation need be sought for. The errors of this ingenious person seem to have consisted in his

having erected his system on the narrow foundation of only one or two of the principles of the animal economy, and in pushing these to an extreme. Had he referred a larger class of diseases to over-excitement, which his system seems to admit of, his doctrines would have been more tenable, and would probably have lived longer. It is doubtful, however, whether they would have spread so far, and been so enthusiastically embraced; for something strikingly new, and even absurd, seems indispensable for giving a popular prevalence to medical, as well as religious tenets. There seems, nevertheless, to be in the doctrines of Brown, as far as their narrow principle will admit, and when received under a fair and temperate interpretation of their import and merits, some suggestions not unworthy of the attention and imitation of the sober and candid practitioner.

IV.—*The Assimilative Principle.*

This power consists in processes peculiar to life, effecting certain combinations and decompositions, also peculiar to life, and manifesting itself in those operations which are carried on in digestion, sanguification, and secretion, as subsidiary to the growth and repair of the individual, and the perpetuation of the species. When we consider the nature of the changes produced on

the aliment in the living stomach and duodenum,* and the shortness of time in which it is effected, there will appear sufficient proof, even in this stage of of assimilation,† that there are agents at work, totally different from those of inanimate matter. The familiar fact of the shortness of time in which the aliment becomes acid in depraved digestion, is also expressive of the singular powers of animal chemistry, a change being produced in an hour or less, which, out of the body, could not be produced in several days. But this difference becomes still more striking, when we contemplate the ultimate results of these processes, and that by virtue of the living powers, the aliment, whether vegetable, animal, or mixed, is converted into matter of the same chemical character, as what is found to exist in the flesh and bones of every species of animal. The flesh and bones, for instance, of an ox, an animal subsisting on pure vegetable food, of a lion, an animal subsisting on pure animal food, and of a hog, an animal subsisting on mixed food, though differing in some of their sensible qualities, are identical, considered as chemical compounds, and exhibit changes totally different from, and utterly inimitable by any chemical pro-

* I have said duodenum, in consequence of some well deduced remarks on the function of this organ by Dr. Yeats, in an article in the 6th vol. of the Transactions of the College of Physicians. London, 1820.

† See Examination of Chyme, by Dr. Marcet, Medico-Chirurgical Transactions, Vol. VI. p. 626.

cesses of which dead matter is susceptible. It is one of the curious and inexplicable questions on this subject, how it comes about that azote enters as much into the composition of the flesh of graminivorous and herbivorous animals, in whose food no azote is found, as it does into the flesh of carnivorous animals, in which this principle abounds. There is none in the food of the former, and it appears by the very accurate experiments of Mr. Allen and Mr. Pepys, that none is absorbed from the respired air ; but, on the contrary, that there is more azote (now more commonly named nitrogene) in the expired than the inspired air. Not only therefore, is none abstracted, but some must have been generated by the elaboratory powers of life. The same gentlemen have discovered that, in the ordinary respiration of an adult person, there are more than eleven ounces of carbonicacid extricated from the lungs in twenty-four hours, a quantity greater than what could have been supplied by the aliment, whether vegetable or animal. The same may be affirmed of phosphorus, which is an essential constituent of bone. It is found in the urine, and abounds particularly in that of the horse, though there is little or none in his food. Some of the French Physiologists are unwilling to admit that animal matter can be formed but from food containing azote, and allege that animals cannot exist under the use of food in which it is not found, such as gum, sugar, and oil. The futility of this assertion must be manifest, when we

reflect that cattle are fed solely on grass, which is destitute of this element. From the great quantity of carbonic acid expelled from the lungs in the expiration both of carnivorous and herbivorous animals, it would appear that this also is a creation of the vital energy. But one of the most astonishing proofs of this creative, or rather transmutative power of life, is that enormous mass of calcareous earth which derives its existence from testaceous animals. For it is undeniable, that whole islands and districts of country, not to mention submarine tracts and mountains, the total of which constitutes a mass of matter which bears a sensible proportion to the globe of the earth, are formed of calcareous matter, consisting of the *exuviæ* of shell-fish, under the form of marble, limestone, chalk, coral, madrepore, &c. Whoever reflects for a moment must be sensible that it is utterly impossible that this mass of matter could have pre-existed in the food of testaceous and crustaceous animals. Some more minute observations and experiments may be adduced in favour of this singular process of nature. One of these I owe to my friend that eminent chemical philosopher, Charles Hatchett, Esq. He found in analysing the bones of a chick which was far advanced in incubation, that they contained phosphate of lime, though neither phosphorus nor lime are discoverable in those parts of the egg from which it must have derived its nutriment. For a similar fact, I am indebted to my friend Dr.

Thomas Thomson, professor of chemistry in the University of Glasgow. He found iron in a newly hatched chick, though none can be detected in an egg before incubation. There are also large quantities of phosphate of lime found in the shells of crustaceous animals.* There is nothing in all these statements at variance with what we know of the potent and creative energies of the assimilative and formative principles of life,† engaged as they are, not only in the service of these inferior animals, but in rearing, upholding, and repairing the stupendous fabric of that superior animal, or living microcosm which controls the elements, and sways with absolute dominion the sceptre of the animated kingdoms of nature assigned to him at his creation.

The new, important, and very interesting discovery of the application of Voltaic electricity for effecting chemical changes, apparently bears some analogy to these animal processes.‡ The changes accomplished by the actions of life, may

* See an article in Phil. Trans. Vol. 99, P. 315, by Charles Hatchett, Esq.

† This brings to mind the motto from the Scriptures, selected by Mr. Locke, as appropriate to the title-page of his Essay on the Human Understanding :—" As thou knowest not what is the way of the spirit, nor how the bones do grow in the womb of her that is with child, even so thou knowest not the works of God, who maketh all things. Eccles. ix. 5.

‡ The idea of the identity, or rather analogy, of the pro-

be conceived to be effected through the agency of some imponderable fluid, or radiant matter as it is otherwise called; such as electricity, light, or magnetism. We can conceive, for instance, that each gland may be furnished with a sort of Voltaic apparatus,* for effecting the specific change in the production of the secreted fluid, and the like may be said of the formative processes, in the production of the various organs and solid parts. That the presence and accumulation of imponderable fluids are not foreign to the animal functions, may be illustrated by the electrical battery of the torpedo and electrical eel, the flashes of light from the eyes of some animals of the feline genus, and from the glow worm and fire-fly. Some physiologists seem disposed to refer the assimilating process entirely to nervous power; † but the like assimilations take place in animals without nerves,

cesses of the Voltaic battery, with the processes of animal assimilation, was first broached in 1806, by Berzelius, in his Animal Chemistry; in 1808, by Professor Brandis, of Kiel, in Holstein, in a work entitled Pathologie oder Lehre von den Affecten des lebendigen Organismus. (See Hufeland's Bibliothek der practischen Heilkunde, 1809, Book I. p. 38, *et seq.*); and the next year, by Dr. Wollaston, in an article in Tilloch's Magazine. See also a paper in the Philosophical Transactions, by Sir E. Home, with experiments by Sir Humphry Davy and Mr. W. T. Brande. Phil. Trans. 1809, p. 385.

* See this illustrated farther in Dr. Young's Medical Literature, p. 110, Lond. 1813.

† See Experiments by Mr. Brodie, Philosophical Transactions, 1814; and Enquiry into the Laws of Life, by Dr. Wilson Philip, London, 1818.

and in vegetables; and the nerves, though they may, by collateral influence, act as stimulants, vehicles, modifiers, or even disturbers of action, these organs are not to be regarded as the point from which the initial action takes its start. Nervous action is found in some instances even to retard and disturb the assimilating process; for it is matter of observation, that in many cases of hemiplegia, where the nervous power is withdrawn or impaired, digestion goes on better than in ordinary health, and an obstinate ulcer has been found to heal quickly after the limb was struck with palsy.* This is further illustrated by an ingenious and conclusive experiment described in the Quarterly Journal,† where, though the nerves of the stomach were divided, digestion and all the processes of chylification went on as before. This argument is farther strengthened by the manner in which the assimilating process is carried on in vegetables, for they have no nervous system; and in one view the assimilating energy may be regarded as more vigorous in this kingdom of nature than in the animal kingdom; for vegetables can transform into their own nature substances such as water, earth, and air, in their inorganic states; whereas no substance can in any case supply nutriment to ani-

* Dr. Charles Webster on the Connexion of the Stomach with Life. Lond. 1803.

† See the London Quarterly Journal of Science and the Arts, No. 13, p. 165.

mals but such as is in the state of organized matter, either vegetable or animal, recent, or more or less decayed; unless what is alleged regarding fishes, in the note at page 92, can be proved.

The main source of physiological controversies, particularly in what regards the nervous system, seems to be the want of discriminating the direct from the indirect, the *actuating* from the *influential*, *collateral*, or *intervening* agencies of the several organs. The author's meaning may best be illustrated, by a comparison borrowed from mechanism. In all complicated machines, the purpose or ultimate result is effected by a number of springs, wheels, &c. accelerating, retarding, or giving new direction to the main action, but every one of them is indispensable, or *sine qua non* to the production of the proposed effect, which is the diagonal, as it were, of these compound forces. Thus by means of the balance wheel and balance spring of a watch, the power of the main-spring can not only be arrested, but the motion of the whole machine can be accelerated or retarded at pleasure. Here the main-spring is the actuating power, the balance-spring the influential agent, which, though it modifies, it contributes nothing to the power which puts the whole in motion. In like manner the efficient, or primary power, in the process of digestion, is inherent in the stomach; but this process may be promoted, impeded, or variously controlled and modified, by

the influential power of the nervous system, a power quite distinct from that assimilative power in which the function of the stomach consists. There is perhaps no department of nature in the investigation of which there has been such a discrepancy of opinion as in this branch of physiology: nor any perhaps in which there have been so many appeals to experiment; witness the innumerable, merciless, (and I am sorry to say, abortive and nugatory) experiments on living animals. The ambiguity and uncertainty of these, which have excited so much warm controversy, seem explicable chiefly on the principle here adverted to, namely, the different and opposite interpretations of results produced, not by the direct agencies of cause and effect, but by concomitant and collateral influences.

As a farther proof that the nervous power is not indispensable to the creation of either the fluids or solids of organic beings, we may adduce not only the fact of the *placenta*, and the curious case of the monster without brain and nerves described by Dr. John Clarke* and others, but that, as above stated, whole classes of animals are without these organs, not to mention the whole vegetable kingdom, in which the formation of solids and fluids is equally an act of vital energy as in animals.

* See Philosophical Transactions, 1799.

A similar mode of of reasoning will apply to the experiments and arguments of those, who wish to prove that Galvanism is identical with the nervous power. And besides, when we reflect that in the changes brought about by Voltaic electricity in inanimate matter, there is a limited number of the combinations of pre-existing principles; whereas those of living organic bodies present countless varieties of newly created qualities, not only in the solids and fluids of every species of animal, but in the bark, the wood, the roots, fruits, and juices of every vegetable production, it must be confessed, that, though these newly discovered processes assist our conceptions, and abstract our imaginations from the gross ideas of the humoral pathology, (for it is deducible from what has been said, that all the modifications of animal and vegetable matter must originate in the solids,) they are quite inadequate to account for the transmutations taking place in living organic bodies, and that there remains a gulf or barrier, perhaps for ever impassable, between the attributes of animate and inanimate nature.

In the sense which I have affixed to the term Assimilation, it is applicable in general only to matter in a fluid form, whether the product of digestion, chylification, sanguification, or secretion. When those portions of matter pass into a solid form for the purpose of growth and repair, a new process commences, which I have called the

Formative. But in none of the stages of this series of transmutation, is there the least resemblance to any of the changes which are produced on inanimate matter by chemical action. They are all brought about by the action or contact* of solid organs, in the form of glands, or follicles, or of membranous surfaces, indued with the power of animalising the fluid alimentary matter, and giving it those innumerable properties of solids required for the growth and repair of the body.

It is of the highest moment in physiology and pathology, that correct notions on this subject should be entertained; for there has not been a more abundant source of errors, whether theoretical or practical, than that of conceiving that the various changes above enumerated, are either identical with, or allied to, the chemical changes belonging to inanimate matter. We ought constantly to bear in mind, that all effects produced on the living body, whether in its solid or fluid parts, are referable to principles peculiar to life, and that most if not all the means proposed for controlling their actions, or altering their quali-

* One of the most conclusive proofs of the virtue of mere contact may be taken from the action of that horny, rigid, unsecreting surface in the gizzard of fowls; which, notwithstanding these properties, effects a sensible change on the qualities of the *massa cibaria.* Nor do the gastric juices, according to the most correct researches, produce real digestion, that is, animal assimilation on aliment exposed to it out of the living stomach.

ties, must be addressed to the properties of vital, and not of inanimate matter. It ought also to be constantly borne in mind, that the blood or other fluids of living animals are endowed with life as well as the solids. One of the most obvious and plausible objections made to this doctrine, when first broached by Mr. Hunter, was, that the attributes of life could belong only to organic structure, which implies that degree of cohesion in which solidity consists. To obviate this objection, it is necessary to define in what sense this life of the blood and other fluids is to be understood. And here we find the advantage of having made an enumeration of those elements in which life consists, a point extremely important to be insisted on, for this great and important principle of physiology is still questioned, and by a few even rejected. It seems impossible that those who have done so, could have considered the subject with due attention; as nothing it appears, can be made out by more correct inductive reasoning. For if any of the qualities above enumerated as peculiar to life can be proved to belong to the fluids of a living organic being, the point will be decided. But it has been proved, beyond the reach of cavil, that two of them, the conservative and temperative, qualities equally predicable of *fluids* as of solids, do belong to them. There are, indeed, other elements of life, such as the Generative and Formative, which are incompatible with fluidity, inasmuch as they imply the action of organs; and

organic structure and action can belong only to solid parts, indued with cohesion. But the resistance to putrefaction, the resistance also to external heat and cold, are as conceivable qualities in fluids ever so quiescent, as in solid bodies. The fact of blood passing spontaneously into the form of vascular texture, was also employed by Mr. Hunter as one of his proofs of its life; and the changes which take place in the transition from the fluid to the solid state in the formation of organs, is utterly irreconcilable with the attributes of inanimate matter. It is rather surprising, that a fact so obvious and striking as the seminal liquor, a secreted fluid, becoming immediately organised, should have escaped him as a proof of the same principle. And it is evident that the arterial blood, though it does not contain the ready formed materials of the solid parts, must nevertheless be impregnated with such vital properties as to prepare it for those important and incomprehensible processes in which the formative energy consists. Besides, Fontana found that the properties of newly extravasated blood could be affected by poisons, and Dr. Philip found that they could be affected by the Voltaic action, neither of which could produce such effects but on living matter.

But as fluids, for want of cohesion, are incapable of assuming an organized structure, while

they retain that form, and therefore incapable either of initiating or giving direction to motion, all the initial actions of life, as well as its ulterior processes, must be referred to the solids; and it follows, that the virtues of medicine should be directed to those attributes that belong to solids; that is, excitability, sensibility, and contractility. Yet, from what has been said of the existence of the attributes of life even in extravasated blood, it does not seem impossible that medicines may act directly on the fluids.

It has been questioned whether there are any medicines whatever which operate on principles purely chemical. The destruction of a morbid acid in the stomach by means of an alkaline absorbent, although producing a palliation rather than a cure, is unquestionably a chemical action; but in those recesses not within the immediate reach of deglutition, the changes seem all to depend on vital action. The action of mere chemical power may also be maintained with plausibility with regard to the remedies for urinary concretions. There can be no doubt of the relief obtained in these cases by the use of remedies sometimes acid, sometimes alkaline, according to the indications derived from the nature of the concretions, that is by the acids in cases of white gravel, and by alkali, magnesia, or lime, in cases of red gravel. But it may be alleged, that this relief is referable to the alteration and improvement of the diges-

tion, and not to the neutralization of the acid and alkaline bodies, which in such remote mazes of the circulation, seem hardly accessible to remedies thus applied. And as all acts of secretion, whether healthy or morbid, are acts of vitality, it follows, that the agents which are qualified for producing changes in them must be such as operate on the principles of life. It is in favour of this that there are remedies of the sedative kind, having a sensibly good effect on gravel, of which the operation can only be referred to vital action. Of this kind are opium, hemlock, and hyosciamus. I had the first intimation of the use of hemlock in gravel from Dr. Black, Professor of Chemistry in Edinburgh; and Dr. Prout, so well known for his learned and diligent researches on this subject, first made known to me the virtue of hyosciamus, as an auxiliary remedy in the same disease. I can say, that in my own practice I have found the most striking benefit in such cases, from combining these, particularly opium, with the chemical remedies; and there is nothing I am better convinced of, than that the cure is rendered by this treatment more certain, more expeditious, and more permanent,* than where the chemical remedies alone are employed. The same principle

* See an article in the 3rd volume of Transactions of the Society for the Improvement of Medical and Chirurgical Knowledge, London, by Sir G. Blane, 1812. Re-published in his Select Dissertations.

may also be illustrated by attending to the virtue of opium in the cure of diabetes. This being a disease clearly referable to a morbid action of the assimilative process, the nature of the agency by which it is cured can only be such as acts upon vital energies, and to this class opium certainly belongs. I have found it in my own practice to be preferable to all other remedies, and it is satisfactorily confirmed in the practice of others.*

Besides the main purpose of the assimilating process, namely, that of creating and maintaining a due quantity and quality of the several fluids necessary for growth and repair, there are some secondary purposes of these fluids too important to be overlooked. By their specific stimulus in the various cavities in which they are prepared, they serve to excite the healthy action of these organs, such as the stomach, intestines, and blood-vessels. The mechanical distension also which they give by their bulk, is not less necessary in supporting their action, and even life itself, as will be more fully explained in another part of this work. The importance of these is no where more conspicuous than in the stomach, the first stage of assimilation; and, as it is the only organ which converts foreign

* See one of the testimonies to the good effects of this practice in an article in the 4th volume of the Transactions of the College of Physicians, by Dr. Pelham Warren.

and dead matter into living animal matter, its energy must be regarded as peculiar and eminently powerful. By its universal sympathy, it exercises a strong influence over every other organ and function. A blow upon it is more certainly fatal than upon any other part of the body. Its aberrations, therefore, form some of the most copious sources of disease; and for this reason, as well as from its situation, it is the first stage for all internal appliances, to whatever quarter they may be directed. There seems, therefore, to be some rational grounds for the present fashionable pathological doctrine of referring all diseases to the stomach, and of curing them all through it. To this doctrine there lies the great objection to which all matters of fashion are liable—that of pushing it to an extreme, by following it out to the exclusion of every thing else.

Before quitting this subject, it may be remarked that the assimilative matter in the food of man is perhaps of a more mixt nature than that of any other animal. From an examination of the human teeth and intestines, as compared with those of carnivorous, frugivorous, and graminivorous animals, and as respectively adapted to each class of aliment, it appears that the organs of man are calculated for the subduing, preparing, and digesting of every species of food. In a practical view, as far as respects man, these may conveniently

be divided into three classes, the animal, the farinaceous, and that which consists of roots, fruits, and greens. A mixture of these, in various proportions, according to the various constitutions of individuals, is the most salutary; but if a restriction to any one of them were on any occasion to become necessary, there seems good reason for selecting the farinaceous. Constant and full meals of animal food alone would be found too stimulant, and would oppress the system with rich and redundant fluids; which, combined with indolence, and the inordinate use of fermented liquor, are found to be the great parents of gout, and other chronic disorders. On the contrary, roots, fruits, and greens afford such slender nourishment as would not suffice for the generality of constitutions, and are more liable than the other classes to flatulence and acidity of stomach. The farinaceous class, being intermediate to these two, is the least liable to objection. Besides, the quantity of pure animal food necessary for sustenance is so small in bulk, unless when taken in excess, as not to afford that distention to the stomach which enables it to perform its functions with advantage: whereas recent vegetables are liable to the opposite objection. It may also be remarked, as one of the innumerable provisions of beneficent Providence, that farinaceous substances are the gifts of agriculture, the most salutary and virtuous occupation of man, and the most conducive to

civilization. The important professional instruction deducible from this is, that for the reasons above-mentioned, the diet to be recommended to the sick should be taken chiefly from the farinaceous class. There is one disease, however, consisting in a morbid state of the assimilating organs, in which the exclusive use of animal food is most advisable. I mean diabetes, a disease, the nature and theory of which is extremely dark. It is a matter of conjecture whether the generation of saccharine matter, which is one of the principal diagnostics of this disease, depends on a vitiated digestion, or some error in the organs of chylification, sanguification, or secretion. The ultimate process takes place in the kidneys, for no saccharine matter is discoverable in the blood. But from the nature of its principal remedies, and from other considerations, it evidently depends on a vital, and not on a chemical cause.

V.—*The Formative Principle.*

This may be distinguished by the epithets Organizing or Plastic. It has not usually been stated as a principle distinct from the assimilative. In so far as the simple change of matter is concerned, an act of assimilation does indeed take place in the formation of organs; but this is the smallest part of the Formative process, the essence of which consists in

the fabrication and moulding of the various organs, and differs from the assimilative, as an edifice does from the materials of which it is constructed; nay, more so, for the fluid particles, in assuming solidity, undergo a change in their chemical constitution, none of the forms of the matter composing the solid parts having any pre-existence in the fluids, as is sufficiently evident from what has been said at page 70, concerning the changes undergone by the aliment, through the agency of vital processes. The creation and application of these materials to the rearing of the wonderful fabric of the living body, is one of the most astonishing phenomena which the human mind can contemplate. Each act of this formative principle in building up and sustaining the structure of organs, is stated by the profound Blumenbach to be a continuation of that *nisus* by which the whole was called into existence in the moment of conception. And it is certainly not less mysterious; for what can be more incomprehensible in the whole compass of nature, than the act in which that conversion and accretion of elementary particles is effected, by virtue of which the various forms of organized animal substance are created, at the very point of time and space, in which this conversion and accretion is called for, and there and then moulded into the form of the respective organs which they constitute; that these organs should be precisely adapted to the ends of nature,

the growth of each keeping pace with all the others; and that these unceasing processes of growth and repair should go on with such harmony on both sides of the body, as to produce that correspondence and symmetry which we behold! These powers belong to the extremities of the capillaries which in the aggregate may be considered as one vast laboratory, for forging, fashioning, and moulding, by an endless number and variety of energies, a like number and variety of structures and organs, whether composed of bone, cartilage, membrane, muscle, tendon, or ligament. In deeply and closely meditating on this subject, it will be found to elude the keenest research, and overwhelms the mind of man with astonishment and despair, from which it can find no refuge, but in resting on it as an ultimate fact, and referring the whole to Supreme intelligence. Should any one attempt to scan it farther, by ascending higher in the scale of natural causes, he will either find himself baffled, or will be in hazard of falling into some extravagance, such as that of Van Helmont, who held that there is in living beings an intelligent principle which he called Archæus, presiding over and directing the secret movements of the animal machine; or of Stahl, who referred it to the rational soul. In that early stage of science, these were not unnatural notions to spring up, on a subject so dark and unfathomable, in ingenious and contemplative minds, endowed at the

same time with a warm imagination; and they are notions certainly not less venial, nor less abhorrent to reason, than the theory of the sun and planets, conceived by their cotemporary and countryman, Kepler, to whom the palm of high genius and intellectual excellence will not be denied. This very celebrated mathematician and astronomer, who first ascertained that the ratio of the mean distance of the planets to their periodical times of revolution, was as the cubes of the former to the squares of the latter, and solved other important and abstruse problems in physical astronomy, conceived that the sun and planets were animated beings, that the rocks were to be considered as the bones of the earth, the seas and rivers as her blood, the metallic veins as abscesses, and that she performed her daily rotation on her axis, and her yearly revolutionary journey in the ecliptic, by an act of her own will, in concert with that of the sun. So difficult is it, as Mr. Locke says, to discover in our intellectual researches, the horizon which separates light from darkness.

The proper function of the formative faculty, is growth and repair. The long and universally received mode of conceiving the progress of growth, was that of a constant accession of organic matter, giving additional dimensions to the parts nourished. But it is evident, that this mode

of accretion would render the preservation of shape utterly incompatible with the enlargement of length and thickness; and it was first clearly demonstrated by Mr. John Hunter, that the only process by which the growth of solid parts, particularly bones, could be carried on, was by a constant removal and replacement of particles. Absorption is, therefore, one of the main instruments of the formative faculty. The effete substances, the *ramenta* or *detritus* as it were of the living body, after being detached by absorption, and set afloat in the circulation, are conveyed through the mass of blood, and eliminated by the excretory glands and emunctory outlets, such as the kidneys, the intestinal and salivary glands, also the exhalants of the skin and lungs. There are exceptions to this law in the growth of the shells of fishes and the teeth of the mammalia, these not requiring an adjustment to adjacent parts like articulated organs.

The absorption and replacement of solid parts goes on in the adult, as in the adolescent state; for the actions of life making an incessant consumption of the solids as well as of the fluids, require an incessant repair by new supplies of aliment. One of the most curious problems, though, perhaps, one of the most difficult of solution, that could be proposed in animal science, would be to ascertain how much of the identical

matter of which the body is composed at birth, remains at any given period of future life, or at death in old age. This question, besides being too hard for the author to grapple with, is, perhaps, more curious than useful; and I shall leave its solution to those who have more ability and leisure.* When the subject comes to be more clearly investigated by anatomical and physiological research, it will probably be found that different organs, membranes, and viscera are affected in different degrees by this powerful engine. Perhaps the brain will be found to be the least affected by it, not only from the comparative scantiness of these vessels, but from the consideration, that the memory and other faculties of the mind, and even personal identity itself, may naturally be thought to depend more or less on the identity of the matter

* There is another problem regarding the assimilating and formative processes equally difficult, but the due discussion of which does not belong to this place; I mean the accounting for the sources from which fishes derive their ultimate subsistence. Man, and other animals, dwell at the bottom of as vast an ocean of air as fishes do in that of water. But it is alleged, that on the submarine plains and mountains, there are no vegetable productions as on our earth, and that it would be absurd to suppose that the denizens of the ocean could for ever subsist by devouring each other. Some respectable philosophers and naturalists have been led to believe, from facts collected from the natural history of such small fishes, as herrings, gold and silver fish, that these, and others most likely to be the prey of the larger fish, have other means of sustenance than through the mouth and stomach.

composing that *viscus*. It seems also to favour the same opinion that in those diseases in which absorption has acted most powerfully and caused great shrinking and emaciation, the brain is not affected.

Farther remarks on the absorption of solid parts will not be out of place here, being closely connected with the subject, and throwing light on some of the most important parts of physiology and pathology.

The matter of which the urine is composed seems to be the effete parts, not only of the fluids, but of the solids, hard and soft; for the solid substances found upon evaporating this excrementitious fluid, seem to contain not only those particles detached from the various organs in the processes of health, but also the morbid concretions so incident to it, and which no doubt form a part of that *detritus* of these organs which is removed in order to make room for fresh accretions. The salivary glands are also outlets for the *ramenta* of the bones. Bone has been found on analysis to contain phosphate of soda, of lime, and of ammonia, the concretions on the teeth, called tartar, and the earthy concretions which frequently form in the salivary ducts, are found, also, on the authority of Dr. Wollaston and M. Fourcroy, to consist of these elements. It is also conceivable that the

solid parts thus absorbed and set afloat in the blood in order to be eleminated by their respective emunctories, may be detained, or by an *error loci* may be determined on a wrong outlet, thereby proving a source of disease. May not urinary concretion and various cutaneous disorders, be produced by such a cause? Does not this, in some measure, account for these glands being the parts upon which determination is made by the operation of mercury, which consists in exciting an active absorption of solid parts, as I have elsewhere observed?* It may here also be remarked, that one of the active effects of mercury is to deprave the natural sensibility of the lacteals, which under its influence absorb fecal matter, as is discovered by the smell of the breath; the fetid particles being carried into the circulation, and thrown off in the *halitus* of the lungs, or by the salivary glands, in consequence of the mouths of the lacteals losing that selecting tact, whereby, in their sound state, they reject whatever is offered to them except the chyle. Mercury excites the energy of all the absorbents. It was a remark of Dr. Cullen's, that the weight of the body is diminished to a greater degree and more rapidly by a course of mercury, than by any other remedy or by any disease. A diminution of thirty

* Transactions of a Society for the Improvement of Medical and Chirurgical Knowledge. vol. 2, page 206 and 210. London, 1800. Re-published in Select Dissertations in 1822.

pounds in a fever is common enough, but a salivation will diminish it by fifty pounds in as short a time. The absorbent action of this medicine preys not only on the soft parts, such as the fat and the muscles, but on the bony parts. It is by virtue of this action, that it removes nodes and the hard edges of chancres. I have seen a chronic head ache of long standing, though not suspected of being venereal, removed by a course of mercury. There can be little doubt that the disease was either a soft tumour or a bony excrescence. A bony excrescence of a vertebra of the neck was removed by a course of mercurial friction, after producing the most alarming symptoms by pressure on the spinal marrow.*

Some of the most remarkable instances of excess of the formative process, are deformities, as the word implies, such as indolent tumours and exostoses. And examples of its defects may be instanced in rickets, *mollities ossium*, and cases of the absorption of entire bones, as the skull † and *vertebræ*.

Another instance of that property of the absorbents by which, in their natural state, they take up only one species of matter and reject all others that are exposed to their mouths, may be adduced in jaundice. For the absorbents on the inner sur-

* See Trans. Med. Chirurg. Society, vol. 3, page 119.

† See a very remarkable case of this by Dr. Nicholls, in the *post mortem* examination of the Rt. Hon. George Grenville.

face of the gall bladder absorb only the watery parts in health; but when an obstruction arises from the receptacles and passages of the bile being gorged, the absorbents do then by compulsion, as it were, take up the bile itself, as appears by its diffusion in the urine, in the eyes, and on the skin. Some late experiments of Dr. John Davy have thrown farther light on this subject of elective absorption. He found, that when compound gases were injected into the cavity of the thorax, some were absorbed, others rejected. *

Were I to form any theoretical conjecture regarding the proximate cause of the sea-scurvy, I should, with considerable confidence say, that it consists in an interruption of that salutary renewal of the organic parts which, by the ordonnance of nature, is indispensably requisite for maintaining their respective functions in their due vigour. The interstitial stagnations, the vascular infarctions, the induration and tumefaction of some of the softer solid parts, the tender, fragile, and almost putrid state of others, the almost total suspension of the healing process, the dissolution of the callus of fractured limbs, are circumstances all of which might naturally be expected from a deficiency of wholesome aliment and an absence of that active state of absorption and renewal which, in health, are in constant requisition for the pur-

* See Phil. Trans. 1823.

poses of growth and repair. And it follows from this view of the subject that the operation of the citric acid as a remedy, is that of a specific stimulus to the absorbents, and not either as nutritious matter, nor as a chemical antiseptic, according to the theories of the humoral pathology. The sorbefacient action of this and other remedies in other diseases throws a resplendent light on several points of practice and pathology, and is one of the most important improvements we owe to modern research. This has lately been illustrated with convincing clearness in the operation of iodine in the cure of bronchocele, and gives a double interest to the other curious properties of this principle, with the discovery of which chemical science has lately been enriched.

The most remarkable part of the operation of this faculty, next to that of growth and repair, is the restorative process through the creation of new parts, terminating in cicatrisation and the formation of *callus*, for the repair of injuries, a process evidently depending on the same energy by which the same organs were originally formed and moulded. And it is to be considered as morbid only when excessive or misplaced.

The great instrument of this process is inflammation, as manifested in suppuration and ad-

hesion, the production of new vascular textures, and other organic parts. It is not a little singular that in all the theories of inflammation, I have read or heard of, this view of it should be overlooked, whether considered in the light of a salutary provision of nature, or as a morbid phenomenon.

In the scheme which I have proposed to myself in this work, my main scope has been to analyse and enumerate the fundamental faculties of life, and to obtain a more clear elucidation of morbid deviations, by considering them as they stand related to these fundamental faculties. Now, with regard to morbid inflammation, what is it but an excess of the salutary process under consideration, the most important part of which consists in the formation of new parts? Yet this is hardly adverted to in the common treatises and theories on this subject.

Another theory of inflammation is that which makes it consist in a preternatural admission of blood into the arteries, in consequence of the weakened and relaxed state of the vessels of particular parts. This theory will, plausibly enough, apply to the erysipetalous inflammation, or that of gout, but not at all to that active and vigorous inflammation which produces adhesion by the crea-

tion of new vessels and other organic substances, subservient to the process of restoration, or terminating in suppuration and abscess. The theory of inflammation, therefore, which accounts for it by supposing the vessels of the part affected to have been in a state of laxity whereby they yield to the impulse of the blood and become gorged with it, proceeds on a narrow and incorrect view of the subject, and cannot be conceived to apply except to that semblance of inflammation, called suffusion or to erysipelas.

Another very obvious illustration of the removal and replacement of solid parts by the formative process, may be gathered from the repair which is necessary to counteract that incessant friction which takes place in the play of the joints, which would very soon wear out these organs, were there not a copious supply and active transformation of matter by the formative process, to compensate for what is abraded by such strong attrition. And were it not for the same operation of this process, the superficial parts of the body would be exposed to rapid destruction, as may be familiarly illustrated by the shortness of time in which dead skin, in the form of a glove, is worn out; whereas, the natural integuments of the hands are so constituted and repaired as to last for life, and even become stronger and thicker

by friction, as is evident in the hands of labourers.

As human life advances into old age, the same quantity of matter required to replace that which is removed, becomes less and less necessary; for that decay which limits the duration of life, consists greatly in the vessels becoming more and more rigid; and from minute ramifications being obliterated altogether, both absorption and accretion become more slow and languid. There is, therefore, less demand for the assimilated fluids which furnish the materials of growth and repair; consequently, a redundancy of blood is extremely common in old age, especially when the assimilating powers remain unimpaired, as is frequently the case, and is most likely to happen in those constitutions calculated for longevity. It is conformable to my own observation, as well as that of others with whom I have conversed on this subject, that, in consequence of the plethora produced from the cause above-mentioned, aged people are frequently subject to spontaneous hæmorrhages, which are not only innoxious, but salutary. I was lately called to a lady aged 82, emaciated and weak, labouring under a profuse hemorrhage from the nose, by which nearly a quart of blood was lost. It was followed neither by faintness nor weakness, but by an improvement in health, in point of vigour and alacrity, evi-

dently proving that there was a redundancy of blood, the removal of which gave relief. Other similar cases have not unfrequently occurred to me. That of the late Sir Walter Farquhar, himself an eminent physician, was as remarkable as any. He died at the age of eighty, after an illness of about eighteen months, the most distressing circumstance of which was evidently owing to a redundance of blood. He was under the necessity of reducing his diet to the most slender articles of nourishment, such as asses milk and rennet whey. He suffered so exceedingly from the sensation of universal heat, which he compared to that of being in an oven, that he was obliged, as the only means of relief, to have recourse to very frequent bleedings. This can no otherwise be accounted for but by a continuance of the assimilative principle, while there was a cessation of the formative. As there was great debility and emaciation, it seems probable that this quantity of superfluous blood could not have been supplied by such a small quantity of aliment, and that the solid parts which were absorbed, were, by some unknown process, converted into blood. I had occasion to know of a female, aged 100, who, in an attack of pneumonia, had been freely and successfully bled in the arm. Sydenham gives very strict cautions against bleeding aged people, without assigning any reasons, and without any exceptions or qualifications,

resting, no doubt, on the plausible notion, that old age being a state of exhaustion and debility, a loss of blood must always be detrimental. This is perhaps true in a majority of cases; but I am well convinced that practitioners will fall into frequent and fatal errors by adhering to it as an invariable rule. On the other hand, it may be here remarked, that excessive abstinence is not favourable to longevity. I found, on making enquiry in Catholic countries, that the life of the monastic orders, who practised an ascetic life, did not in general attain to an advanced age. So true is it, as a maxim in human life and conduct, physical and moral, that what is most commendable and expedient consists in the observance of a *medium* in all things.

Since the publication of the last edition of this work, my attention has been attracted to a passage in one of Mr. T. A. Knight's late communications to the Royal Society (See Phil. Trans. Vol. 100, p. 183) in which, among other points of analogy between animal and vegetable life, he states the following: "I observe that grafted trees of old and debilitated varieties of fruit become more diseased in rich soils, and when grafted on the most vigorous stocks; which has induced me to suspect, that in such cases, more food is collected and carried up into the plant than its leaves can prepare and assimilate, and

that the matter thus collected, which would have promoted the health and growth in a vigorous variety accumulates and generates disease." Mr. Knight enlarges much on the analogy of the functions of vegetables, as compared with animals, particularly those instinctive processes in which they so much resemble sentient beings; and the above mentioned observation is very apposite to the present subject.

VI.—*The Restorative Principle.*

It is well remarked by Dr. Gregory,* that the animal machine differs from all others in this, that it carries in itself the means of repairing the injuries and disorders incident to it. A species of restoration, consisting in the repair of solids and fluids, rendered necessary by their perpetual waste and depravation, has just been mentioned. This has reference to the support of the material fabrick of the body; but what is further meant here to be designated, consists of laws belonging and indispensable to the principle of life itself. The first is, "Nature's sweet restorer," SLEEP. That state of excitement of sensation, thought, and voluntary motion, by which all living beings subsist in their ordinary existence, cannot, by the consti-

* See Conspectus Medecinæ Theoreticæ, V. i. p. 5.

tution of nature, be maintained, without a daily suspension of several hours. It is evident from this that vital power is a *quantity* of something or other that is exhaustible, and liable to be expended by the exercise of its own energies. Sleep being one of the universal and indispensable wants of nature, is highly important, and one of the most prominent features in the natural history of life; and being indispensable, nature, with her usual wisdom and kindness, has provided great powers of accommodation, suited to the emergencies of human life. With a view to this, it is observable, that the refreshment of sleep is not in the simple ratio of its duration, the principal share of this act of restoration being found to take place in the beginning of it. If a person be at any time deprived of one half, or more, of his usual portion of it, the inconvenience experienced is by no means in proportion to this privation; and habit will bring persons, whose affairs require it, to subsist in health and vigour with a small allowance of sleep. General Pichegru* informed me,

* The singular exertions and alertness of this leader of the revolutionary armies of France, need not excite surprise, when we reflect that he performed what I believe is not to be met with in the ancient or modern annals of Europe. In a climate, in which, during all former wars, it was deemed impracticable to carry on the operations of a campaign through the winter, he kept the field for two successive winters, that is, from the time at which he stormed the lines of Weissemberg in the end

in the course of my professional attendance on him, that, in the career of his active campaigns, he had for a whole year, not more than one hour of sleep at an average in twenty-four hours. I have been informed on the credible testimony of others, that, on occasions of being awake the whole night, they have found sufficient refreshment for the duties of the ensuing day from half an hour's sleep in the morning. According to my own experience, I find, that when I have been called out of bed, after half an hour's sleep or less, I experience a very great difference in my feelings next day, from what I have felt when I have had no sleep at all. The powers of the *sensorium* seem to be wound up, as it were, at the most rapid rate in the first period of sleep; and great part of the refreshment in the later hours, seems more imputable to the simple repose of the organs, than to the recruiting power peculiar to sleep. There are some persons, to whom more or less sleep has become habitually necessary in the

of 1793, and drove the Duke of Brunswick across the Rhine, till he over-ran Holland in January and February, 1795. He informed me, that in all that time his armies had no camp equipage, and that their only substitute for tents was an occasional light hutting of turf and boughs which could be erected in a few hours. On enquiring respecting the health of his armies, he answered, that sickness never prevailed among them, except in a detachment which he sent against Sluys, in Dutch Flanders, which suffered severely by the intermitting fever incident to that marshy district.

course of the day, particularly after dinner; and they find that a few minutes of it satisfy nature. But the most striking illustration of this principle, which I have met with, is what I learnt from a gentleman of great observation and intelligence,* who had been long in China, and had an opportunity of seeing the habits of the Missionaries. These pious and conscientious persons felt themselves bound to abstract as little time as possible from their duties, and took the following method of abridging the period of that sleep which habit had made necessary to them in the middle of the day. They threw themselves on a couch, with a brass ball in the hand, and under it a brass bason. The moment they dropped asleep, the ball dropped from their hand, and ringing on the bason, waked them. This they found afforded all the recruit which nature required.†

* Matthew Raper, Esq.

† Since the first edition of this work, the author has met with a somewhat similar remark in Q. Curtius, regarding the private habits of Alexander the Great, Somni naturâ parcissimus, etiam vigilantiam adjuvabat si quid occurrisset quod seriâ meditatione dignum videretur, comprehensâ pilâ argenteâ, brachium extra lectum porrigebat, ut in subjectam pelvim illapsa, excitato sonitu torporem in somnum deficientis discuteret. It appears from a passage in Diogenes Laertius, that this practice was invented by Aristotle, exercised upon himself, and taught to Alexander. It is mentioned by another historian, that Alcibiades disciplined himself in the like manner.

This principle admits of a valuable practical application; for in the business of human life, particularly in circumstances of fatigue and long continued exertion, short intervals offer which are well worth being taken advantage of for the purpose of refreshing nature. Persons so circumstanced may, for the want of knowing this, think it not worth while to compose themselves to rest for so short a time, only to be disturbed when their pleasing oblivion had just begun.

The only other remark which occurs to the author to make on this subject is, that there are many persons so constituted by nature as seldom to enjoy an undisturbed night's rest, even in their best health, but who nevertheless feel the same refreshment and the same aptitude for their daily duties as those who pass the night in sound sleep. I knew a gentleman, who lived in uncommonly good health to upwards of ninety years, who said he seldom knew what it was to have a quiet night. And every practitioner, even of moderate experience, must have observed, among females particularly, who labour under nervous affections, that they enjoy more vigour and alertness after restless nights, than after those in which they had enjoyed profound and uninterrupted sleep. On a general review of this subject, it would appear that the beneficent Creator has so constituted animal existence, that such a latitude should be allowed to

this restorative principle, as is compatible with the unavoidable contingencies incident to the calls and duties of human life.

There is reason to believe that sleep is necessary to the existence, not only of every species of animal, but of vegetable. The periodical diurnal collapse in the ~~leaves of plants~~ petals of flowers, is referred by Linnæus, and other naturalists to sleep.*

The other branch of the restorative element which has been stated, is the spontaneous cure of diseases and accidents, or what is commonly understood by the *vis medicatrix naturæ.*

It may at first sight seem not natural to class this with sleep; but as the epithet *restorative,* applies strictly and literally to both, and as both are attributes exclusively applicable to vital existence, they come under one head when considered under this aspect. Fatigue may in some sense indeed be reckoned a disease or injury, of which the means of restoration is sleep. The main difference consists in this, that the one is as indis-

* See an article in the Hamburgh Magazine of 1759, by Professor Zin, of Göttingen, entitled, Von dem Schlafe der Pflanzen. The collapse of the petals of flowers takes place at stated hours of the day, different in different plants, and Linnæus has, by arranging a series of these, constructed what he calls a vegetable clock.

pensable as food towards the daily support of life, whereas the other is so only contingently and occasionally.

The energies of nature displayed in combating and subduing diseases and wounds, and in restoring mutilated organs, are so undeniable, and so obvious to the most cursory observation and reflection, as to need no proof. A cut finger, or the renovation of a lobster's claw, affords sufficient evidence of it. Artificial remedies can seldom be considered in any other light, than that of auxiliaries to the spontaneous principle of restoration; and if such a principle did not exist, not only the human species, but all living existence would long ago have become extinct.

It is manifest that in the diseases excited by morbid poisons, such as the plague and small-pox, there is brought about in the course of the disease, an insensibility of the whole system to the action of the poison, for convalescence commences at a period when the poisonous matter is accumulated to the utmost; and the event, instead of proving fatal in a certain proportion of cases, would necessarily terminate fatally in every case, unless provision had been made against it by this insensibility, which arises in the course of its action. And what is farther remarkable is, that in the case of specific poisons, such as the small-pox and measles, this

insensibility to the virulent impression of the infectious matter continues, with very few exceptions, through the remainder of life.

In the case of those morbid poisons, the nature of which is not to excite febrile commotion in the system, such as the *virus* of the syphilis and itch, this insensibility to future attack does not take place. It would appear from this, that fever is a salutary process, by which a spontaneous cure is effected, by bringing the system into a state of insensibility to the poison. It may be farther inferred, that in those infectious disorders in which fever does not arise, there is more room for artificial cure, nature not having made the like provision as in the other class.

But though fever may be an operation referable to the *vis medicatrix naturæ*, it may require the repressing hand of art when too impetuous; for many of the phenomena of disease seem to consist in the struggles of this self-healing energy; and it is one of the great difficulties of medical philosophy so to interpret nature, as to ascertain and determine what symptoms and sufferings are referable to positive disease, and what to the warfare of the restorative with the noxious principle It might plausibly be maintained, for instance, that all the leading phenomena of fever, consisting in a regular series of movements, producing

crisis and types, is the campaign which nature carries on with various success in warring against the hostile invasion of disease. This has been properly enough called the re-action of the system; but this re-action, though in its nature salutary, may exist, either in excess or defect. For instance, —if one of the morbid poisons exciting fever, should assail life by attacking one of its fundamental principles, the generating power of heat, as manifested by the rigors by which febrile invasion is ushered in; this principle may re-act with such violence, as to make it one of the main objects of practice to repress it, either by internal remedies, or by the external application of cold: and the converse of this will happen, should the re-action be too feeble. This is well illustrated by a passage in Sir James Macgrigor's account of the campaigns in the Peninsula, in which he states that the military hardships were sometimes so great as to extinguish the power of re-action, so that the men of feebler *stamina* expired, from being so exhausted as to destroy that energy by which robust subjects, under the like trial, were thrown into fever. Such seems to be the case with those subjects who are overtaken with almost instant death after being exposed to the infection of the plague.

With regard to the spontaneous cure of wounds,

it may be viewed, as has been already remarked, (page 109) as one of the manifestations of the pre-existing or sustaining powers of nature; for what is the spontaneous cure of a wound, but an example of the same assimilative and formative processes, upon which nutrition and growth depend; and what are these but a continuation or emanation of the generative energy? These three might properly enough be arranged in one class, or rather order of functions.

The business of art, therefore, in promoting the sanative process, consists chiefly in removing the obstacles to nature's restorative operations. This is strikingly exemplified in the operation of opium. The main bar to the self-healing process in many disorders consists in morbid irritability and sensibility, which being removed by opium, nature is left free to act.

In all solutions of continuity by violence, there is a spontaneous tendency to what is called union by the first intention, in cases where parts can immediately be brought into contact, as exemplified not only in the case of recent wounds, but of the Tagliacotian operation, which has of late been adopted into regular surgery. This power of re-union remains even for some time after the parts have been separated, as has been proved by some late examples of small members adhering after a

considerable interval of separation.* When this resource has either not been practicable or has been neglected, there is a resource provided through the medium of inflammation and suppuration. Union by the first intention seems to have been much overlooked by the earlier improvers of surgery, and they preferred the method of throwing the injured parts into large suppurating surfaces, whereby cures were rendered both more painful and more tedious. Modern surgery pays more regard to the method by the first intention: and we have in this an example of the practical advantage of entertaining correct physiological ideas, and true conceptions of the extent of nature's resources.

It may be further remarked, that it is on the operations of the sanguiferous system, and the changes producible on it by art, that this restorative faculty, practically considered, chiefly depends. It is the unremitted motion of the blood which sustains life from the first moments of conception, as discoverable in the *punctum saliens*, till the last moments of vital existence; and whenever it is stopped but for an instant, sensation, consciousness, and all the active functions of life are suspended, as is clearly exemplified in syncope, from suspension of circulation in the

* See Medical and Surgical Journal of Edinburgh for 1814, p. 421, and the same work for the year 1815, p. 450.

brain. And it not only sustains life, but is the instrument of restoring all lesions and assaults made on its integrity, from a cut finger to the most dangerous accidents, and the most formidable operations of surgery. It also supports in an eminent degree the conservative and temperative energies; for if the circulation is stopped in a limb, it loses its heat, and passes into gangrene. The artificial means of relief also consist chiefly in such agents as have a tendency to incite the action of the sanguiferous system, if too languid, or to restrain it, if too impetuous.

I shall conclude with one remark more on this subject. As artificial means of restoration are called for, only while nature is preternaturally affected by disease or accident, in order to assist her in converting the morbid into the sound state, these remedial agents must be pernicious in a state of health; for as every thing in a state of health is already as it ought to be, any change, such as every active remedy must cause, cannot fail to be for the worse. And it follows on the same principle, that the virtues of medicines cannot be fairly nor beneficially ascertained by trying their effects on sound subjects, as has been plausibly enough imagined and practised; because the particular morbid condition which they are qualified to remove, does not exist.

VII.—*The Motive Principle.*

By this is meant muscular action, in its most extensive sense. The motions taking place in the living animal body, for carrying on its various functions and actions, are strikingly distinguished from those of the external world, inasmuch as they are not referable to gravitation, chemical attraction, mechanical impulse, nor any of the other causes by which the particles of inanimate matter are put in motion. All the attempts that have been made to explain muscular motion, by referring it to any of these principles, have been grounded on gratuitous hypotheses, and have therefore terminated in abortive speculations. It is stated here, among the ultimate and inexplicable attributes of animal nature.

The living motions are manifested not only in the action of the voluntary and involuntary muscles, strictly so called, but in the vascular system. It has been questioned whether certain other organs possessing vital contractility, but not a fibrous structure, such as all the excretory ducts, the ureters, the urethra, the skin, and various membranes, ought properly to be deemed and denominated muscular. This seems little more than a matter of verbal arrangement; but

as this contractile property is excitable by *stimulus*, and quite distinct from the simple elasticity of inanimate bodies, it seems most natural and convenient to admit them into the class of muscular organs. The sphincters and pores of the skin are in some sense an exception to this, for their action consists in dilatation as well as contraction, but both being vital actions, they are to be reckoned muscular.

The voluntary muscles are excited to action by the will: the involuntary muscular organs, consisting chiefly of the heart, the circulating and absorbent vessels, and the intestines, are excited by their contents, which partly by their bulk act mechanically in distending their containing tubes and cavities, partly by the peculiar qualities of their contents acting as specific *stimuli*. A certain degree of mechanical tension is indispensable also to the action of all muscles. No muscle, whether voluntary or involuntary, can exert its contractility, unless the fibres are previously in such a state, that if divided they would shrink by their resiliency, leaving an interval between the cut extremities. The same may be said of the vascular system in all its ramifications, in order to give play to their contraction in grasping and propelling their contained fluids. That this action is carried on in the great trunks by their irritability and contractility, independently of the propulsion

of the heart, is sufficiently evident from the phenomena of local determinations from the circulation being carried on in cases where the heart is in so morbid a state as to be inefficient,* and from there being animals having circulation, without a heart. And that this holds in the remote parts of the circulation is undeniable, from the active processes carried on by the capillaries, and from the circumstance of the circulation in the liver and placenta. A state of permanent tension is necessary for all those functions, and even for the existence of life itself, as is exemplified in the fatal effect of profuse hæmorrhage, particularly if it is sudden, so as not to give time for contraction. In short, no muscular organ could otherwise make that contractile exertion which is necessary for the performance of its function. Nor is there any character of life more expressive of its nature than the universal state of tension of every fibre, and that state of pressure in which every particle of living matter, whether solid or fluid, must consequently be found in every living being: nor is there any more certain token of the extinction of life than the absence of all tone and pressure: extraneous pressure is also necessary to life, for the surface of the body is pressed by the whole weight of the atmosphere.

* One of the most striking of these is that recorded by Mr. Allan Burns, of Glasgow, in which the whole heart was in a sort of osseous state.

The power of the loco-motive, and other muscles of volition is in proportion to the degree of their simple tone. It is obvious how much more difficult it must be to contract an elongated and flaccid fibre than one that is braced and shortened. The like principle holds good with regard to the stomach. The extreme suffering induced by the long privation of food, seems as much owing to the want of its habitual tone as to the want of that repair which all organs require from food. In cases of extreme fatigue and hunger, very great relief is experienced by a tight bandage round the stomach.* In such cases, this has been found to avert not only extreme languor, but apparently death itself. There are many well established practical facts in favour of this, such as the useful practice of swathing, after the operation of tapping for the dropsy; also in cases of great exhaustion from severe and dangerous parturition. In the latter cases, the swathing of the lower extremities has also been practised, but this probably operates by confining the blood to the vital parts. The healthy action of vessels, particularly of the absorbents, is greatly promoted by pressure. Upon this is founded the excellent treatment, by the tight strapping of ulcers, introduced about the beginning of this century, by Mr. Bainton. A similar

* Capt. Inglefield's narrative of his escape from the Centaur of 74 guns, which foundered in the Atlantic Ocean, in the year 1782, is strongly in support of this fact.

treatment has been found successful in rheumatick affections and tumours, in the practice of Dr. Balfour, of Edinburgh, and Dr. Grattan, of Dublin.

The serious effects arising from the sudden removal of tension, as when a patient faints on the opening of an abscess, and when death itself has been known to supervene suddenly on a large evacuation of the bowels, and even the bladder, are in like manner to be accounted for. It was for this reason, that, in opening large abscesses, such as what is called the *psoas* abscess, a practice has been adopted of letting out the matter gradually, or at intervals; for which I believe we are indebted to the sagacity of Mr. Abernethy.

It was upon the same principle that I was induced to make trial of the effect of compression in certain cases of hydrocephalus, a practice which has been found eminently successful in my own hands as well as those of others. *

If the healthy state of tension in the arterial system were to cease suddenly from any other cause beside hæmorrhage, such as the operations of a poison, life would equally be extinguished; and it is conceivable, and not improbable, that such

* See my Select Dissertations, page 380.

is the operation of some of those poisons which produce a momentary effect in destroying life. It may be farther illustrated by the effect of the lessened pressure of the atmosphere on the surface of the body in ascending high mountains. This is accurately stated, and well reasoned upon by M. de Saussure,* who describes the sort of distress arising from a very light atmosphere, as producing a species of muscular debility and syncope, quite different from that which occurs either from fatigue or from the defect of oxygen, but resembling exactly that which is felt from profuse hæmorrhage, the vessels being so relaxed as not to be able duly to grasp their contents; nor is this to be wondered at, when it is considered that the pressure on the surface of the body at the level of the sea was 32400lb. 12 oz. the barometer standing about 29.9 inches, while it stood at the summit of the mountain at 16 inches, so that the pressure was little more than one half of what it usually is.

The effect of tension and pressure is also very remarkable on digestion. Nature has wisely provided, that, along with the pure nutritious matter of the food, there should be a certain admixture of unassimilable matter, in order to give it more bulk, and thereby more tonic energy to the sto-

* See Voyage dans les Alpes, Vol. 1. p. 486.

mach. The most invigorating articles of food, accordingly, are such as are introduced into the stomach in a solid form; and not only devoid of fluidity, but possessing a certain degree of hardness and tenacity, so as to excite the powers of the containing viscus to stronger action. It is found, in the human species, that plain solid food, combined with a certain proportion of unassimilable matter, is infinitely more efficient for the purposes of health and strength, than that which consists of pure alimentary matter, the different species of which are gelatinous, albuminous, oily, or saccharine. And with regard to animals, it is a well ascertained fact, in horses, that their strength is much better sustained by hay than by grass; for the stomach being an organ of universal sympathy, does, by the contractile exertions on which it is put in digesting hard food, confer vigour on the whole frame. This valuable and curious observation is farther corroborated by the following experiment made by John Hunter. He took two dogs, one of which he fed on rich broths, the other with solid meat. The former became weak and emaciated, the other strong and fat.* This bears some application to practice; for, in cases of febrile and inflammatory affections, it would

* Dr. Clarke fed two dogs on the same portions of muscular flesh; to one he gave the juices in a fluid form, to the other, the dry fibres; the former became weak and lank, the other strong and fleshy.

follow (as we find to be actually the case) that a very little solid animal food is too stimulating, and therefore hurtful, while the same in the form of broth is safe.

On the same principle, it may be suggested whether there is not an advantage that the diet of seamen, even in its most improved state, should consist in part of hard biscuit and salted meat; and, though much benefit would certainly result from fresh meat, soft bread, and a certain proportion of fresh vegetable matter, it would be still advisable to retain a considerable number of the articles of their old bill of fare.*

But the most obvious and common, as well as the most fatal effects, observable by the removal of tension from the cavities of living animals, are those which arise from the abstraction of the circulating fluids, more especially by the sudden depletion of the vascular system by hæmorrhage, as already observed. Hæmorrhages are either spontaneous, in which case they are generally salutary efforts of nature to relieve repletion, or they arise from violence, as in wounds. Spontaneous

* It is remarked by Mr. Thomas Reid, in his intelligent Tour in Ireland, that he learnt from the peasantry of the county of Tyrone, that potatoes imperfectly boiled, go farther in sustaining their strength, than those which have been softened by complete boiling, and that they availed themselves of this as a means of economy in times of scarcity.

hæmorrhage is very seldom fatal, and if left to itself, so as to induce syncope, the progress of it is stopped by the suspension of the circulation; and time being given for a *thrombus* to form, it does not return on the revival of the person so affected. The case is different with regard to hæmorrhages from external injury, for this is not brought on like the other, as the means of relief to excessive repletion. In loss of blood, therefore, by external accidents, not only compression and ligature are required, but in extreme cases, the aid of stimulant cordials and of opiates. It is well ascertained by surgeons, whose duty it has been to attend to recent wounds in battles by sea and land, that the most successful method of saving life endangered by profuse hæmorrhage, is by the free use of brandy or laudanum, or of both.

But great discrimination seems required here; and in order to establish a principle by which the judgment is to be guided in these important points, it is necessary that we should be aware of the distinction between *active* and *passive* hæmorrhage. In the former, the discharge of blood is, I apprehend, to be referred to the high tone of the vessels, in the latter to their relaxed state. It is evident, therefore, that in a hæmorrhage, while the vessels are under the strong action of their tonic contractility, there could not be worse practice than to administer stimulants and opiates. According to the antiquated theory,

opium having been observed to favour hæmorrhage, it was alleged to do so by rarifying the blood. This applies well when the hæmorrhage is active, but not gone to a dangerous extremity. But when the discharge has advanced so far as to exhaust the powers of life, and even to subdue the arterial tone itself, it is then that these remedies are imperiously called for, whether the hæmorrhage be active or passive.

Some further practical instruction may be derived from an attention to this principle, in discriminating the different nature of the fulness of blood vessels. There is a simple fulness of them called suffusion, such as occurs frequently in the eyes and eye-lids, which does not seem at all to partake of inflammation, and is to be treated by tonic and stimulant applications. Genuine inflammation differs from this in the extreme, and requires the opposite treatment of evacuant and antiphlogistic remedies: there are intermediate degrees, such as the erysipelatous inflammation, requiring the exercise of judgment in the adoption of an intermediate practice.

There is a very interesting class of cases in which hæmorrhage constitutes the most alarming symptom, and in which there has existed considerable ambiguity with regard to the treatment. Perhaps a candid attention to the principles here adverted to, and a fair application of them, may

afford the grounds of settling the difference of opinion which has arisen on this subject. The cases alluded to are those of flooding, particularly after child-birth, and frequently attended with syncope and convulsions. When convulsions occur before or during labour, they are commonly attended with lethargy, and other symptoms of pressure on the brain, which clearly indicate the necessity of depletion; and there can be no doubt of the propriety of blood-letting, local or general, even though there should be syncope and hæmorrhage, the latter being, under such circumstances, of the active kind. But the cases to which the author alludes, and to which he has occasionally been called as a general physician, are where great alarm arises from the occurrence of these symptoms immediately *after* labour. His experience is certainly limited; but he finds five cases in his notes of this description. One died from pure exhaustion and depletion: no active means were taken to save her. In three others he was induced, from the fatal event of the former case, and by the success which he had heard of, in a similar one, from the use of strong cordials, to make trial of this treatment in the subsequent cases, which he did with the most satisfactory results. Such cases are undeniably of the passive kind above described, for they occur after the strength has been exhausted by the severe throes of labour, by the loss of blood, beyond that which takes place in the course of nature, in the con-

traction of the uterus, and by the sudden removal of tension on the expulsion of the child; besides the alarm and agitation of mind at such perilous and painful moments. The vigour acquired by cordials at this crisis, may also be naturally supposed to assist the uterus in the expulsion of the placenta and secundines, of which the adhesion, bulk, and irritation, are the most common causes of hæmorrhage. One of the cases which the author alludes to, was that of a young lady, in her first labour, whom he found in a state apparently, of extremity, having lost all consciousness, but fortunately retained the power of deglutition, though compulsory.* She was recovered by a quantity of brandy, which it was computed would have intoxicated three or four men; yet she felt no such effect from it, nor any inconvenience whatever, the stimulus being merely sufficient to restore and sustain life. The fifth was one officially reported to me, of very profuse flooding, in which the patient took at once two hundred drops of laudanum, and half that quantity, several times, at the intervals of four hours. The author has been induced to state these cases from having found by the language of respectable practitioners and authors, that the practice in such cases is held to be very ambiguous, with a reluctance among some of them to admit that there are *any* cases whatever which admit of such

* A very remarkable case of the same kind is recorded in the 16th vol. of the Medical and Chirurgical Journal of Edinburgh.

treatment. It would be presumption in the author, from his limited experience, to deny that there may not be cases, even *after* labour, which require to be treated like active hæmorrhages.* But if he is correct in what he has stated, his observations will be deemed of some utility, not only in this particular branch of practice, but (what is more suitable to the scope of this work) it will serve as an exemplification of a point of medical reasoning, which he has already adverted to at page 101, and which he will again have occasion to elucidate, namely, the great danger in the practice of physick of laying down rules so rigorous as to admit of no qualification and exception.†

Since the publication of the last edition of this work, I have read a disquisition on this subject in the review of a work entitled, *Traité des Convulsions chez les femmes enceintes en travail et en couche.* Par Antoine Miguel. This author, in treating the last part of his subject, seems not to be the least aware of the great contrast both in the nature and treatment of the convulsions super-

* Since the publication of the last edition of this work, the author has known the case of a lady who died by apoplexy after labour.

† Some judicious remarks on this subject are to be met with in an article in the Medic. Chirurg. Trans. vol. 1. Lond. 1809. Also in a Treatise on Uterine Hæmorrhage, by Duncan Stewart, M. D. Lond. 1816. There is an article on the same subject,

vening during parturition, and attended with hæmorrhage, and of the like symptoms during pregnancy, in which the most common cause is plethora, and the principal cure is venesection; nor does he advert to the distinction between active and passive hæmorrhage. This is equally astonishing and deplorable; but it will account for a remark which possesses at least the merit of candour, namely, *that hæmorrhage attended with convulsion, is almost constantly, if not invariably, fatal.**

The only farther remark I have to make on this subject is, that there is a great difference in the degree of tension in the original constitution of individuals. This is so true, that it was made the foundation of two distinct temperaments by the writers of the last century; and though the doctrines of the ancients and most of the moderns on this subject, are in general purely fanciful, there seems good sense in this distinction.

The temperament in which there is an excess of tension is called by Baglivi, the *strictum et crispum*, that in which laxity predominates, he

by the same author, in the Medico-Chirurgical Transactions, vol. iv.; also Observations on the Prevention of Abortion, by Suppositories of Opium, in the same work, vol. v. It may be added, that cool air, and the local application of ice have been found highly beneficial in uterine hæmorrhage.

* See Medical Repository for May 1825, p. 422.

calls the *spongiosum et flaccidum*, in English, flabby. Of these constitutions, one is prone to inflammatory affections, the other to erysipelas, dropsy, and excessive obesity. This last seems to consist in a want of the absorption of the fat, from a deficiency of that pressure which belongs to those of a tense fibre. The same flaccidity is exemplified more or less in all the membranes and in the skin. It produces languor and temporary debility, and is indicated by a looseness of the skin, most observable in the scrotum, of which the loose and pendulous state renders such changes more palpable than in the rest of the integuments.—It may here be remarked, that it is on this principle of pressure promoting absorption, that the cure of certain tumours and rigidities by the means of friction is founded.

But it ought, at the same time, to be stated in this place, that excess of tension is one of the most frequent causes of disease and suffering. The pain from all inflammatory affections is caused by an over-distending power of the fluids acting on an over-contracting power of the vessels. The relief, accordingly consists in diminishing the quantity of the fluid and the employment of such remedies as may diminish the arterial action. Pain is in almost every instance caused by the excessive extension of sensitive fibres, whether it proceeds from a mechanical, an inflammatory, or a

spasmodic cause. It is also ascertained, that tension adds greatly to the sensibility of nervous organs, a fact of which the ministers of the Inquisition, in the practice of their tortures are said to avail themselves. The two latter cases ought to be carefully discriminated, for the depletion and other antiphlogistic remedies, required in inflammatory affections, are hostile to spasmodic cases, and the spirituous, aromatick, and opiate medicines, appropriate to nervous affections, are pernicious in inflammatory cases. It is also of practical importance to remark, that the more suddenly the abstraction of the blood is made, the more relief is likely to ensue; for, in this case, the vessels do not so readily contract and accommodate themselves to their contents, as when it is taken away slowly.

And it seems not easy to understand how this local abstraction of blood, which bears so small a proportion to the whole mass, should give such sudden and general relief, unless we suppose, with Dr. Cullen, that it is in consequence of the sympathy subsisting between the whole system and every portion of it.

One of the most difficult and important points in this part of our subject, and in the whole compass of physiology, is to determine what is the value and extent of that connexion which subsists

between the nervous and muscular system. That motions peculiar to life can exist without the accompaniment of brain or nerves, is proved by the existence of those animals which are destitute of them; and by the phenomena of fœtal life, particularly by the abscence of nerves in the placenta; also by those monstrous productions * without brain, spinal marrow, or nerves. The economy of vegetable life furnishes a farther proof of the same principle. The actions taking place in growth, the impulse given to the sap, from the extreme roots of a tree to its summit, and the clasping of tendrils may be instanced as motions not referable to any of the causes of motion in inanimate bodies, and as examples of vital energy, as genuine as those which take place in sensitive life. In the complex animals the sensorium and the system of nerves are indispensable for the purposes of sensation and voluntary motion, and are never wanting, except in cases of monstrosity, in which life cannot subsist beyond the fœtal state.

With regard to the influence of nervous energy

* See cases and remarks by Mr. Lawrence, Trans. Med. Chir. Society, vol. v.; also Dr. Clarke's Case already quoted, and others in Phil. Trans. vols. xix. and xxi. All these afford proofs that secretion and nutrition can be carried on independently of a nervous system. It is also stated in them, that various instinctive motions were performed by these monstrous productions, such as breathing, sucking, swallowing, and shrinking when the soles were tickled.

on the voluntary motions in general, I have stated my opinion fully upon it elsewhere,* and some additional light has been thrown on it by Sir Everard Home,† or still more recently by Dr. Wilson Philip,‡ confirmatory of what I had delivered. I have there stated, that the nervous power is to be considered as a stimulus of muscular fibres, as properly as any chemical or mechanical stimulus; and that the nerves are distinct from muscles in their function as well as the matter of which they are composed. It is not easy to divine how it has entered into the minds of physiologists that the presence of nervous matter should be necessary to the irritability of muscular fibres. It appears contrary to the nature of things that it should be so; for nervous power and muscular contractility are related to each other as cause and effect, and cannot, therefore, be identical. It seems equally absurd to allege that, where nerves cannot be demonstrated, nervous matter must nevertheless be intermixed with muscle, in order to give it irritability.

Mr. Hunter, by a happy turn of expression, calls the function of the nervous system *inter-*

* See Lecture on Muscular Motion, Select Dissertations, p. 229.

† See Phil. Trans. for 1814.

‡ See Experimental Enquiry into the Vital Functions, 1817.

nuncial. It is evident that some such principle must exist in the complicated system of the superior animals, in order to establish that connexion which constitutes each individual a WHOLE. There is no more difficulty in conceiving nervous power to be distinct from that by which muscular contraction, secretion, and heat are produced, than in distinguishing between the power of the helm which guides the vessel, from the power of the wind which impels it; and in following out the parallel, it may be affirmed, that if a ship were never to steer but one course, with a wind of the same power and direction, the helm would be useless, just as a nervous system would be useless in a simple animal. It is accordingly found only in complex animals.

Let it not be thought, therefore, that because digestion, secretion, or the generation of heat are impeded or suspended by the interruption of nervous influence, that nervous influence is the efficient, substantive, and actuating cause of these functions. May it not be stated, also, as another cause of fallacy in estimating the results of experiments on living animals, that the agitation occasioned by the torments they endure, can hardly fail to affect the natural and ordinary play of the functions. The like reasoning will apply to the alleged effect of Galvanic influence, on digestion, secretion, and on the heat of arterial blood; for,

in these cases, not to mention the uncertainty arising from the discrepant results of experimenters, it is more consistent with the analogy of the vital processes, to suppose that it acts the part of a stimulant than that of an original and independent cause.

Upon the whole, it appears that the irritability and excitability of muscular action are not *constituted, created*, or *imparted* by the nervous energy, but that this energy incites, restrains, and regulates these organs, and connects them with each other and with the organs of sense in carrying on the purposes of life.

In considering the matter in a view still more abstract and comprehensive, it seems absolutely necessary, that in complex and sensitive animals, there should be a minute, universal, reciprocal, and prompt connection and intercourse established between every part and every other part; and the anxiety of nature to do this, is sufficiently manifested by the intricate intertexture of the nervous ramifications in the various ganglions, plexuses, and innumerable communications, like the anastomosis of vessels, but still more numerous, running between one branch and another in every spot. Is it not by virtue of this universal, accurate, and close connexion and instantaneous intercourse that the consciousness

of individuality and personal identity is created and kept up? Most of the phenomena of sympathy also are referable to this cause. Let the integrity of this system, and the reciprocal intercourse of its parts be broken down, as in the case of hemiplegia, the members of the affected side are felt as something foreign to the rest of the body. The hallucinations in some species of delirium * and mania, by the person referring his own sensations and actions to another person, also seem to depend on a like morbid disjunction of the free intercourse between the several parts of the nervous system. There is this important inference therefore to be gathered from the great difficulties of unravelling and interpreting the influences of the nervous system with the other functions, and the interminable controversies, to which it has given occasion, namely, that nature in establishing their intricate and intimate connexion, has shewn how necessary the reciprocal influence of every part of the system on every other are, in carrying on the purposes of life as a whole. This controversial contention of physiologists may therefore be viewed as a physiological fact in itself. And considering how all these organs are locked and indented as it were into each other: considering how their functions operate upon each other, reciprocally, collaterally, and in a circle, can it be wondered that so much

* Diseases of Seamen, 3rd edition, page 343.

controversy and ambiguity should have arisen. In so far as facts are concerned enough of them seem to have been accumulated : the only questions are, what interpretation do they admit of, and what useful application, if any, can be made of them? At all events, the friends of humanity will rejoice when an end can be put to the exercise of so much cruelty.

My consciousness of being unable to explain various morbid phenomena belonging to nervous and muscular power, obliges me to confess that there are circumstances connected with the subject which are not at all understood, nor indeed, as far as I know, attempted to be explained. Upon what principle, for instance, can we explain those very painful spasmodic contractions so frequently occurring in the muscles of the leg, or the locked jaw, or the convulsions taking place in epilepsy, hysteria, and in the last extremities of life, which so often occur without any visible lesion either of the brain or nerves. It is remarkable that all these, though seemingly acts of power, do generally indicate a debilitated state of the system. I can see no light into the *rationale* of these phenomena.

There is a function which seems to belong to this regulating and internuncial influence of the

nervous system on the motive organs of complex animals, which appears not to have been duly appreciated and attended to by physiologists and pathologists. I mean that by which fluids of a particular quantity and quality are distributed or determined to particular parts in health and disease. This may be excited even by a thought in the mind, as in blushing, and the occasional afflux to the organs subservient to the appetites and to the *mammæ*. The blood contains not only the alimentary matter necessary for the support of the various organs, and for the supply of the several secretions, but for the conveying of heat, and for supporting the mechanical tension required for maintaining the activity and even existence of the different functions, as is strikingly exemplified when the circulation is suspended in the brain; for, at the same instant there is a suspension of all consciousness and sensation. And when the flow of arterial blood is obstructed in the extremities, the conservative and temperative energies are suspended, as is indicated by the loss of warmth and the supervening of gangrene. We have in this a marked distinction between this and the suspension of the nervous power which merely lowers but does not extinguish the animal heat, acting only an influential part. It is indispensible to health, therefore, that a fair portion of blood should be

distributed to each member of the body, according to its exigency; and it is evident, that, either an excess or defect of this must produce disorder.

But this is not all. There is a provision evidently made by nature for conveying specific portions of the fluids to corresponding glands. It is not meant to apply this to the secretions in general, as if the secreted matter pre-existed in the mass of blood, and were not generated in the gland itself. The observation here stated applies only to the effete, extraneous, or acrid matters which are to be expelled by the emunctories, as noxious or redundant, such as the urine and matter of perspiration. In no other manner can the rapid transmission of fluids from the stomach to the kidney be accounted for. Nor can we in any other way account for the result of an experiment made by Dr. Darwin, in which the nitre taken by the mouth was discovered in the urine, but could not be detected in the serum of the blood. It seems to be for want of this selecting power, whereby the useful and recrementitious fluids are kept separate, and transmitted to their respective destinations, combined with a vicious assimilation and depressed state of the powers of life, that dropsy arises. It is curious to contemplate with what precision fluids are transmitted

through the common mass of blood in health, and conveyed to their respective glands or outlets. As a farther proof of the useful and recrementitious fluids being morbidly blended in dropsy, it is observable that albumen is found in the urine of hydropic patients. There is therefore a selecting and conveying power peculiar to healthy life, not less unaccountable than the operations of the formative process already adverted to, as an ultimate and inscrutable attribute of vitality. It is sufficiently correct to say, that the matter of a secretion is produced in greater or less quantities, by the greater or less energy of the respective glandular organs. But, it is also true, that no exertion of these organs could augment their product without a co-operation, a secret understanding, or concert, as it were, with that general storehouse, the mass of blood, which alone could supply the additional afflux necessary for the encreased secretion: as well might a mill produce meal without a continued and adequate supply from the hopper.

Fluids of a particular character seem to make their way through the general mass of fluids to their appropriate glands, as an acid does, even through a solution of alkali, from one extremity to the other of the galvanic wire, the ordinary affinities being suspended, or rather overpowered, by the electrical attraction. It is not meant to say,

that this is an exemplification of the same process in nature, but only, as before mentioned at page 78, to state a comparison or parallel between the operations of life, and those of the chemistry of inanimate matter, in order to assist our conceptions of the vital energies. It is sufficiently conceivable, that by virtue of that constant pressure which must take place in the sanguiferous system, considered as one great cavity bounded by the sides of a vessel in a constant state of tension, glands might be supplied from the general mass in proportion to their wants and discharges, but this will not account for the supply of the selected fluids.

These processes of specific determination open new views in pathology, agreeably to what has been said at page 93; for as there are certain glands and exhalant vessels of which the proper function is to eliminate the effete solid parts that have been absorbed, or such noxious and acrid fluids as may be floating in, or rather, blended with, the mass of blood, any excess or defect of these, or a wrong determination of them, will be productive of disease, as was exemplified with regard to the urinary concretions, cutaneous defedations, and dropsy. A redundant determination of the blood itself to certain organs, is also one of the frequent constituents of disease; but we can-

not concede to a late pathological writer,* that all diseases whatever, with a very few exceptions, are referable to this cause, there being so many other ways enumerated in this work by which deviations may be made from the sound state.

There are also various extraneous bodies, some of them medicinal, which are, by a specific property, determined to particular organs and emunctories. Thus mercury is more particularly determined to the fauces, squills to the lungs, saline and terebinthinate substances to the kidneys. There are certain fluids which when taken into the stomach, make their way with inconceivable rapidity to the kidneys and the skin, where they are detected by their colour or odour, without any suspicion of having entered into the general circulation.†

When this circumstance in the animal economy first attracted my attention, I was about to enlist it as a distinct head in the catalogue of vital energies, under the title of DETERMINATIVE; but on further consideration, it appeared to me to be one of the manifestations of that universal influence, concert, or sympathy established between

* See Elements of Pathology and Therapeutics, by C. H. Parry, M. D.

† See the Experiments of Mr. Westrumb.

all the organs and functions through the instrumentality of the motive and sympathetick powers.

There are certain paths and channels, aswell as impelling power, by which solid as well as fluid bodies are determined upon various parts, by the like inscrutable energies of nature. There are innumerable well attested cases of small pointed bodies, which, after being swallowed, have, in course of time, made their way to the most distant parts of the body: generally to the surface, but I knew a case in which a needle that had been swallowed was found in the muscular substance of the heart.*

* A case of this translation of pointed bodies was lately transmitted from Copenhagen, so singular that it was thought advisable to have it attested by upwards of thirty professional men, in order to procure credit to it. A young woman swallowed an unknown number of needles. She was nineteen years in discharging several hundreds, by having them cut out by the skin at various intervals, with severe sufferings, frequent fits of convulsions, insensibility, and mania, and extreme emaciation. Her weight was reduced to 120lbs. The disproportion between the *ingesta* and the *egesta* formed also a peculiar feature of this case. An account was taken from February to June, 1822, during which time a hundred and twenty-six pounds of food and drink were taken in, and eight hundred and fifty pounds were discharged by the various emunctories, making a difference of 729 pounds. Besides a large quantity of urine, a great quantity of fluid was discharged by the *vagina*, at the mouth of which there was so great a stricture, that it was drawn off by a catheter.—Another very extraordinary and deplorable event be-

The morbid actions incident to the voluntary muscles, to the heart, and the muscular part of the stomach and intestines, consist chiefly in convulsive contractions, as in epilepsy, and hysteria, or in spasmodic contractions, as in tetanus, cramp, catelepsy, ileus, and spasms in the stomach. The most ordinary morbid condition of the motive part of the vascular system consists in inflammatory affections, and in excess or defect of tone, altering its capacity beyond or within the healthy standard, so as to produce the respective states of excessive tension or flaccidity.

These morbid affections belong to subjects in whom there is an excess of irritability and mobility combined with debility. *Atonia gignit spasmum* is an aphorism of Baglivi, founded on observation and good sense. Although in many cases, therefore, of a spasmodic or convulsive character, there may be so great a degree of plethora and loaded bowels, as to render depletory

longing to this class of accidents, lately took place in the son of an English nobleman, who, by some accident, swallowed a beard of barley. This extraneous body passed to the lungs, and there created so much irritation, inflammation, and abscess as to prove fatal. Various artisans supposed to inhale small particles of dust, such as pin-makers, stone masons, and flax-dressers, are liable to consumption from a like cause: and may not this account for some obscure maladies of vital parts, the causes of which are unsuspected and undetected.

measures advisable in the outset of the treatment, the general style of remedies, whether preventive or curative, should consist in tonic and exhilirating remedies. The spasmodic disease which requires the greatest judgment in timing, properly this mixed practice, is ileus. It commences with pure spasm, but nothing could be more injudicious than to begin the cure with opium, spirituous or aromatick medicines ; for the main indications are to clear the bowels of feculent *sordes* and *scybala*, and to prevent supervening inflammation, by venesection or leeches. After these depletory means, opiates and the warm bath will ensure relief. On examination *post mortem*, I have found a peculiar appearance of inflammation, particularly in the great intestines, consisting of red streaks. I account for this by the mechanical pressure of the spasmodic contractions.

The want of the habitual exercise of these powers, is also a source of disease extremely important to be attended to. There is no institution of nature more evident than the necessity of the actual exercise of all the organs and functions of animal as well as rational existence, for improving them, and for maintaining them in a healthy state. A due degree of labour strengthens, and even multiplies, muscular fibres ; and the want of it produces various chronic diseases not only of the muscles themselves, but of every organ and func-

tion of the animal frame. It is a precept of Hippocrates, *partem quam nutrire vis moveto.* And it may here be remarked, that, even in those surgical cases, such as fractures, where rest is required in order to admit of parts being united, it is observed by a sagacious and experienced practitioner, that this may be carried too far; a state of perfect and absolute rest being unfavourable to the healing even of a fracture. The healthy and vigorous action of the muscular fibres of one organ communicates firmness and strength to another. The action of the stomach required to subdue hard articles of nourishment, as already observed, communicates firmness and strength to the voluntary muscles, which the same alimentary matter in a soft or fluid form does not impart. The indulgence in indolent habits and excess of sleep, by which those ranks of life who do not depend on bodily labour are enabled to gratify themselves, contribute no doubt to create those diseases, particularly the gout, which are peculiarly incident to the affluent. During the twelve years in which I was Physician to one of the largest hospitals in London, there were only 23 cases of gout out of 3835 cases, of all kinds, which came under my care; an irrefragable proof that as labour (I ought to say habitual and unremitting labour) with simple diet, infallibly prevents gout, so its remote cause must be sought for in the reverse of these. Of the manner in which this is brought

about, that is, the proximate cause, I have never seen any rational conjecture, nor am I able to form one myself: but such is the fact. In what manner these indulgences should produce at one time severe articular pains and local inflammation, also earthy concretions of the urate of lime, and that, at other times, they should produce a variety of the most formidable morbid affections of vital parts, are among the hitherto unrevealed arcana of nature. The share which excess of sleep, above the wants of nature, has in creating chronic disease, has probably not been sufficiently attended to, unless we are to except the common popular observation that, all long livers have been early risers. I was informed by Mr. Morgan, who, having been for more than forty years Actuary of the Equitable Assurance Office, was peculiarly qualified to judge of the causes of comparative longevity, that the class of men distinguished above all others, for length of life, was that of school-masters. In forming conjectures on the cause of this, it occurs to me that these persons being unable to afford the means of excessive sensual gratifications and indolence, their duties requiring sobriety and early rising, their constitutions having never been broken or tried by hard bodily labour, scanty or bad nourishment, exposure to the weather, nor inordinate anxiety, are the circumstances which have mainly contributed to their exemption from diseases acute and chro-

nic, above the average of the rest of mankind. Ought not a superfluous share of sleep to be deemed a debauchery, as much as an excess of food and drink? If the proximate cause of gout and hypochondria should ever be discovered, it will probably be found in the relation in which defect of muscular action and excess of sleep, combined with a redundancy of aliment and the habitual stimulation of vinous liquors, stand with regard to the descriptive characters of these maladies. Their first operation seems to be that of begetting a certain *diathesis*, which renders the body susceptible of these morbid affections, on the application of the appropriate causes.

Let it never be forgotten, then, that the perfection and health of all the organs of motion can only be promoted and maintained by that exercise which providence has ordained as indispensable to the practical duties of life, and has conjoined the most pure and substantial enjoyment with the exercise of all the faculties, animal as well as mental. The painful and dangerous diseases decreed as the sanction annexed to the violation of this law of nature, furnish proof enough that such violation cannot be committed with impunity.

But here, as in all human affairs, whether natural or moral, extremes on either side are per-

nicious. Fatigue, that is the over-exercise of the motive powers, is also a cause of disease. Excessive labour strains and wears out the powers of nature, and tends to shorten life, particularly if combined with privations, that is, an insufficiency of wholesome food, clothing, shelter, and fuel, and is indeed a frequent cause of acute as well as of chronic diseases.

The following practical remark arises out of these observations. It occurred to me in a great number of instances, particularly in the early part of my practice, before I was sufficiently aware of what I am going to mention, that when I had occasion to recommend air and exercise, I found that the patient, from misapprehension, in almost every instance, injured himself by fatigue and exposure. Let me therefore admonish young practitioners always to throw in the appropriate cautions in such circumstances.

VIII.—*The Sympathetick Principle.*

One of the characters which chiefly distinguish organic from brute matter is that reference which every part and member bear to others in structure, whereby all the solid portions are so suited to each other, with regard to shape, size, and consistence, as to form one harmonious whole. This as a matter of mere co-operation, applies to the

dead as well as the living state. But the pervading harmony alluded to, becomes still more conspicuous in contemplating with what accordance all the functions are performed in the movements of the living machine. That parts which are in immediate contact should be so adapted mutually as to direct each others movements for a given purpose, is a circumstance in common to an animal, and to a piece of human mechanism ; but it is an important peculiarity of the animal structure, that parts, the most remote, do in many cases, even without the intervention of any visible material agent, carry on a commerce with each other, exciting actions without which the functions of life could not exist.

This is the foundation of the principle of which we now treat, or I ought rather to say it is the very principle itself; for though it has been usual to apply the term sympathy only to those manifestations of it which incidentally occur in consequence of disease, accident, or the operations of medicine, I cannot but think some distinct and exclusive expression ought to be appropriated to a principle so indispensable to all living organic beings. It is evident that this is the principle which incessantly acts in maintaining the sound state of the whole system, to the effecting of which there is required a mutual dependance and reciprocal influence between all the organs and func-

tions, quiescently but actively and indispensably going on. It is from the first of these circumstances, its unobserved quiescence or silence, by which I mean its being imperceptibly and unconsciously carried on, that it has not attracted notice. But what can be more obvious than that it is a principle on which depends, from the earliest moment of existence to the completion of the adult state, that consentaneous accordance in the process of growth, by which the whole species and every individual of it, are reared in that exact symmetry and proportion which constitutes the unity and individuality of the entire being. The phenomena to which the term sympathy is ordinarily applied, are only the remote and occasional manifestations of this latent principle, which is of such importance that I doubt whether I ought not to have assigned it a more advanced rank in the list of the fundamental attributes of life, and some of its properties I have perhaps wrongfully bestowed on the formative process.

The term sympathy has been much objected to, but, as I apprehend, rather fastidiously and unreasonably. It is, like most other terms belonging to the science of life, figurative, being a metaphor taken from an affection of the mind, and an exact translation of the word *compassion*. The import of words, according to the most correct and received rules of philology and rhetorick, is not at

all to be deduced from etymology, but either to be assumed conventionally, according to a definition, or to be adhered to in the sense affixed to it by established usage. By animal sympathy, is not meant the intelligent principle or Archæus of Stahl's hypothesis, but that mutual influence of distant parts, so subtle and rapid as in some instances to be compared to thought or to lightning: in other instances, it is an action more tardy and habitual. If this term is to be rejected, some other must be invented to express what actually takes place in those operations of the living body, by which, without the transmission of ponderable matter, or the intervention of any of its properties, the most indispensable functions are carried on in health; and without which some of the most striking phenomena of diseases, such as their translation and conversion, cannot otherwise be explained. It sometimes consists in the transmission of a mere sensation, without any perceivable change in the sympathising part, such as the dull pain felt in the shoulder in *hepatitis*, the acute pain felt in the thigh and knee in the inflammation of the hip joint, the severe pains felt in remote parts, even the soles of the feet, from stone in the bladder; and on the great scale, the connexion of the stomach with the heart, the head, the kidneys, the lungs, the skin, in short, the reciprocal action of all the functions and organs.

From the innumerable and familiar instances of sympathies between parts the most unconnected and remote, it is evident that it takes place independant of vicinity and of the continuity of parts, not even of the nerves, except in a very limited degree. There is a sympathy depending on mere contiguity, as that of the surface of the body with the subjacent *viscera,* between which there is no anatomical connexion more than between the most distant parts of the body. Much abortive pains have been taken by physiologists to trace it to the ramification of nerves. The medium of communication is probably some imponderable fluid, but for any purpose either scientific or practical, it would only be a waste of time to dwell longer on this subject.

But it is of the utmost practical importance that the fact should be understood in all its bearings, for it is by virtue of this principle that we are so apt to be misled regarding the seat of diseases, and by the operation of which we are enabled to act upon internal vital parts under disease through remedies applied to external parts remote from them. It sometimes happens, also, that there is a morbid suspension of sympathy, and unless we be aware of this, we may be so misled as to form a false prognostick, as when the learned Barthez says, in his terse style, "*Bonus pulsus, bona urina, æger moritur.*"

It will no doubt be matter of surprise to some of my readers, that I should have classed the Sympathetick principle with those which belong to all living organick beings, including vegetables, to whose nature it may at first sight seem entirely discordant, and I feel myself bound to adduce good reasons for this arrangement. If I can do so it will be an additional argument in proof of sympathy being independent of the nervous system.

A tree is evidently an instance of an organized being, all of whose parts stand to each other in the relation of mutual dependance, with that sort of symmetry or keeping, as it may be called, which belongs to an animal, and by which both an animal and a vegetable are constituted individual creatures, possessing a separate unity and integrity, all their members, portions, and functions, acting and re-acting on each other in a manner indispensable to the existence and maintenance of the whole. This may best be exemplified by the vital intercourse kept up between the roots, the trunk, and the branches. For instance, early in the spring, before the temperature of the earth into which the roots have shot has been changed by the influence of the season, such is the effect of the increase of temperature on the parts above ground, that the energy of the roots is excited. It has been found that the foliage of a tree has made considerable progress, and its sap copiously

produced and impelled upwards in the month of April, and at a time when the temperature of the earth at eight feet deep is colder than in January.* This could have been effected only by a sympathetic excitement given by the parts above ground to those under it.

In the smaller members and functions of vegetables, there are indications equally striking and beautiful of the sympathetic relations. This may be illustrated by the irritation of a single leaflet† of the sensitive plant, making the whole of the leaf and its footstalk contract. And if in the winter time the branch of a vine be introduced into a hothouse, it will produce a luxuriant crop of leaves, blossoms, and fruit, the materials of which could only be derived from the excitement of the roots

* See this ably and satisfactorily stated in the 57th Number of the Edinburgh Review, in an article said to have been written by Professor Leslie.

† My friend, Dr. John Sims, so well known for his excellent taste and great knowledge of botany, was so kind as to communicate to me, the following interesting and hitherto unpublished original experiment of his own. A leaflet of the sensitive plant being irritated, and the greatest pains being taken to avoid moving any other part of the leaf, the whole of it nevertheless contracted, and the foot-stalk dropped. But in order to be sure that mechanical motion, communicated by this irritation, had no share in this contraction, he threw a sunbeam, concentrated by a glass lens, on one of the leaflets; the whole leaf contracted, and the foot-stalk dropped.

propagated by sympathy with the parts in contact with warm air;* this will take place even during a frost, in which situation, these roots would have been in a torpid state, had it not been for the sympathetick influence of the parts above ground, brought into action by warmth. The action of the roots, therefore, must be excited from what Mr. Knight, in treating of the same subject, calls "a vehicle of irritation, arising from an intrinsick power of producing motion in vegetable life."†

It is obvious from all this, that the functions of living nature in all its departments is kept up by a mutual concert and correspondent accordance of every part with every other part, and that it would be in vain to waste time in endeavouring to account for them by groping among dark analogies and conjectures. It will be far better to assume them as facts, upon which are founded the ultimate and inscrutable principles of the animal economy. It is only necessary to observe how much processes of health must be deranged from an excess, defect, or total suppression of the sympathetic faculty; and this opens a wide scope to the spe-

* The author is indebted for this fact to Dr. John Hope, Professor of Botany in Edinburgh, whose lecture he attended in the year 1771, at the Botanick Garden on Leith Walk.

† See a series of ingenious Papers on Subjects of Vegetable Physiology, in the Phil. Transactions, from 1801 to 1806, by T. Andrew Knight, Esq.

culation of those who search deeply into the proximate causes of disease, the operation of remedies and the sources of error from the false reference of the seat of disorders.

IX.—*The Appetitive Principle.*

Under this title is comprehended not only that attribute of the adult man, by which the species is propagated and that through which the individual is sustained by aliment, but those propensities of mere animals for food, fresh air, light and heat, which are indispensable for the maintenance of life. This principle is subservient to the generative and assimilative. It cannot be said to make part of them, for their essence consists in those ultimate, fundamental, and inexplicable principles of life, which have been already treated of.

Like all other properties of animal nature, they exist in different degrees of intensity, according to the natural constitution, character, and habits of individuals, and deviate occasionally into the morbid extremes of excess and defect. In that which relates to the generative, we find the excess of it under the title of *furor uterinus,* and some rare cases are recently recorded of individuals who have been strangers to the venereal appetite. A

remarkable instance of this occurred in a question at law, a few years ago, regarding an English nobleman. The point at issue was, whether he was of sufficient soundness of mind to be entrusted with the management of his own affairs. In the course of the trial an investigation was made regarding his conduct in the married state, and it appeared that he had no ideas concerning sexual intercourse.

Though there are great natural diversities and morbid deviations in regard to the appetite for nourishment, it would be incompatible with the continuance of life were it, like the other, altogether absent. It is needless to enlarge on the great varieties of appetite in individuals in their sound state. I shall here only mention in a note a well authenticated case of each. I had occasion to be thoroughly informed in relation to all the circumstances of the first by an official report made to the Medical Board of the Navy, of which I was then a member.*

* The subject was a prisoner of war, by birth a Pole, but in the French service, of the age of 21, very tall, well made, but thin, and enjoying good health, lodged in the prison at Liverpool in the year 1799. He was one of a family of nine, all of whom had voracious appetites. At the age of thirteen he was seized with a degree of voracity of which an idea may be formed when it is found attested that when allowed the rations of ten men he complained it was insufficient to satisfy his cravings. He de-

In considering the case of voracity, it seems to afford reflections, interesting not only in point of novelty and curiosity, but important by the lights

lighted chiefly in raw flesh, and in his rage of hunger he would devour dogs, cats, or rats, dead or alive. He would even eat considerable quantities of grass when sore pressed. In the action at sea when he was made prisoner he took up the leg and thigh of a man which had been shot off and was devouring it till it was torn from him. In order to shorten the details of this singular history, it is only necessary to recapitulate what he eat the day before the account was drawn up. It consisted of four pounds of raw cow's udder, ten pounds of raw beef, two pounds of candles, besides five pints of porter. This is attested not only by the medical officers, but by a flag officer who was present with other gentlemen of honour. One of the commissioners of the Medical Board was also present. The fæces were by no means proportioned to the *ingesta*. The great evacuation was by sweat. He sweated more or less at all times, very much while he was eating, but most of all during sleep, at which time a dense vapour was seen exhaling from his body. As he was exchanged soon after this, the future history of the case is not known.

With regard to cases of extreme abstinence there are many such on record, but they have been much the subject of imposture. One of the best authenticated is that related by Mr. Pennant, in his Tour into Scotland. A woman aged 35 fell into various infirmities of a nervous nature, soon after recovering from a fever. She at the same time took an aversion to all manner of food, and there was reason to believe that for a year and three quarters she swallowed nothing. Strong compulsion was used to force her to swallow, but it was immediately thrown up. In all that time there was no evacuation by the bowels. We have no information regarding the further issue of the case

which they throw on the process by which the food is digested and disposed of. Monstrosity and disease, whether in the structure of parts, or in the functions and appetites, illustrate particular points of the animal economy, by exhibiting them in certain relations in which they are not met with in the common course of nature, nor in the sound state. The power of the stomach in so quickly dissolving, assimilating, and disposing of the aliment in ordinary cases, must strike every reflecting person with wonder; but the history of this case exhibits a still more palpable proof and a more strong conception of these processes, just as objects of sight become more sensible and striking when viewed by a magnifying glass, or when presented on a larger scale. The facts here set forth tend also to place in a strong light the great importance of the discharge by the skin; and to prove that it is more by this outlet, than that of the bowels, that the recrementitious parts of the aliment are evacuated, that there is an admirable co-operation established between the skin and the stomach by means of that consent of parts so observable, and so necessary in the other departments of the animal economy, and that the purpose of aliment is not merely to administer to the growth and repair of the body, but by its bulk and peculiar stimulus to maintain and promote the play of the organs essential to life.

Besides the errors of excess and defect of appetite, there is another, consisting in its depravity. Some of the most remarkable examples of this is that disease of chlorotic females called *pica*, by which they have a propensity to eat chalk and other unnutritive substances, and a disease of the Negroes in the West Indies known among the French by the name of Mal d'estomac, which leads them to indulge in eating clay and such like substances.

There are certain propensities or instincts, if they may be so called, pertaining to vegetables, similar to those of animals, and I have again to remove, if I can, whatever surprise may arise in the minds of my readers, at stating this principle as well as that of sympathy, as one belonging to both kingdoms of nature. It is a well known fact that plants bend and extend themselves towards air, light, and heat, and that by an astonishing appetency implanted in their nature, their roots extend themselves under ground through incredible obstacles to that quarter where alone the water necessary for their sustenance is to be found. This is a matter of common observation, and Gassendi, one of the greatest philosophers of the age in which he lived, observes that if on the soil on one side of a cucumber there be poured oil, and on another water, it will move towards the water. And to the same principle belongs also that faculty

by which the seeds of vegetables, when buried in the ground, feel or judge as it were, whether their germinating organs can reach the surface in search of heat, light, and air; and when they are at a depth at which this is unattainable, they do not attempt to germinate, but retain the power of doing so for ages, possessing an excitability which can be roused into action in case there should ever occur the requisite proximity of light, air, and heat,* with the presence of moisture. Something not unlike this takes place in animals, for it has been found that toads have been found existing in a living state, enclosed in trees and blocks of stone.

With regard to the morbid state of the animal appetites, medically considered, much more is to be feared from their excess than from their defect, for inordinate indulgence is one of the most fertile sources of disease in the human subject; and morally considered as the objects of self-control, the author must leave to moralists the due enforcement of this as one of the main constituents of the virtue, dignity, and happiness of man.

* See this stated in the first article of the first volume of the Transactions of the Royal Society of Edinburgh.

X.—*The Sensitive Principle.*

It must be matter of some surprize to the reader that the author should have allotted a prior rank to principles of so much less importance than this; for beyond doubt that must be the most important principle to man as well as other animated beings, upon which depend his intercourse with the external world, his conscious existence, his enjoyments and sufferings. To account for this and for his departure from the order in which these principles stood in the former editions of this work, he must recal the reader's attention to the new arrangement at page 33, in which he drew the line of demarcation between that class of living existences which are without a nervous system, and those which possess it.

Sensation being a simple idea, does not admit of definition; but its import may be understood by a reference to some of its descriptive attributes, such as pleasure and pain, and to the several perceptions conveyed through the organs of sense adapted for receiving the impression of their external objects. To these might be added consciousness and volition; but as elements of the intellectual operations and mental emotions, they

belong to man as a rational and moral being, and are foreign to the present subject, which professes to embrace only his animal nature. It belongs to this place, however, to advert to this aspect of the human character, in as far as it exercises an influence over the corporeal frame, thereby adding to that complexity of agents, that obscurity of effect, and that difficulty of analysis, which it is the purpose of this rapid sketch of the animal powers of man to elucidate.

Sensation and voluntary motion, also appetite, in so far as it is referrable to sensitive beings, in in the language of M. Bichât, a modern French physiologist of considerable fame and great industry, compose (if I rightly comprehend his meaning) what he calls *Animal* life. The other faculties, by which must be meant the Generative, Conservative, Temperative, Assimilative, Formative, Restorative, Appetitive, and Sympathetic, as enumerated and defined in this work, none of which necessarily imply sensation, volition, or consciousness, he terms *Organic* life: by which also is meant, I believe, what some other French physiologists term *Automatick* life. But the distinctions made by these authors are either so ill defined, or I am so dull that I confess I do not clearly comprehend them. And I shall only

farther remark on this subject, that there is not perhaps a more absurd and gratuitous assumption to be met with in the annals of science, than that of one of the most renowned philosophers of the same nation, that brute animals are mere machines devoid of sensation, and therefore unsusceptible of pleasure and pain, unless indeed another theory of the same author, in accounting for the revolutions of the heavenly bodies on the hypothesis of VORTICES, is to be placed on a level with it.

It is deducible from what has been said, that all the elements of life as enumerated at page 33, are independent of the Sensorial or Nervous System, except the Sensitive, the Imitative, that part of the Motive which is subject to volition, and that part of the Appetitive, which implies sensation and voluntary action; for though they are all influenced, and more or less guided by the brain and nerves, they possess an independent existence, as is exemplified in the lower animals, and in vegetables.

It has already been remarked, that all the senses carry a reference to the material world, each having a corresponding object in external nature, to which its structure is adapted. Were it not for the great familiarity of the subject, the adaptation

of the eye and ear to the properties of light and air, would strike us with the most intense delight and astonishment. The same may be said of the other senses, and of the conformation of the hand, and of the whole body in its stature, and the relative position of its limbs and viscera, as adapted to the laws of gravitation, and the mechanical properties of matter.

The perfection of the sensitive principle, therefore, will consist in its fidelity to nature, and this fidelity consists in the uniform identity of the sensations excited in each individual. This identity is not necessary in separate individuals; for though the same corporeal affection of matter which excites a red color in the eye of one person, were to excite that of yellow in the eye of another, all the purposes of intelligible intercourse would still be answered, provided this continues constant in the individuals respectively: neither could they discover that their perceptions of the same object is different, nor could any misunderstanding therefore arise in their communications with each other, whether verbal or written.

It would appear from some recorded and well authenticated cases, that there is some subtle subdivision and distribution of the nervous fila-

ments, whereby those of sensation are rendered distinct from those of motion.* This was long considered as a mere matter of fact and observation, not accounted for in that stage of physiological enquiry; but the cause has lately been explained chiefly through the well-directed and persevering industry of Mr. Charles Bell,† who discovered that there are two series of nerves proceeding from the spinal marrow, one of which serves the purposes of sensation, the other of motion.

It has also been remarked how essential it is that the human mind, as well as the bodily organs, should be physically adapted to the constancy of nature. It is on this constancy that all our experience and judgments are founded, whether in

* See a case related by Dr. Yelloly, Med. Chirurg. Transactions, vol. iii. another by Dr. Brown, in the American Repository, and a third by Lamark in his Zoologie Philosophique, in all which, there was a total loss of sensation, while the muscular powers and circulation remained perfect.

† See his ideas on the New Anatomy of the brain, in his Letter to Dr. Cooke, inserted in his (Dr. Cooke's) work on Nervous diseases, vol. ii. p. 1. London, 1821. See the same confirmed in a work of Mr. Majendie's, Paris, 1823. Mr. Bell has the farther merit of having discovered and elucidated several other important anatomical and physiological facts, respecting the origin, distribution, destination, and functions of different sets of nerves, for which the reader is referred to an article on this subject in the Phil. Trans. for the year 1821.

operating upon matter, or in our intercourse with our fellow-creatures, the one having relation to that reliance which we have on the invariable course of nature in the physical world, and the other on that of the moral world. It follows, that the morbid state of the senses will consist not merely in simple excess and defect, constituting over-acuteness, or hebetude in the corporeal frame, but in those false references regarding the affections of the rational and moral frame in which depraved judgment, delirium, and mania consist.

XI.—*On the Imitative Principle.*

This faculty seems, at first sight, to belong to rational beings, that is, to man in his adult or adolescent state, being apparently a deliberate act of reason, consisting in the adjustment of means to ends. Certain it is, however, that it is exercised not only by the human species, in the earliest infancy, but by several species of brute animals, even those of inferior sagacity to those who do not possess it. It is for this reason that it is here stated as an attribute in common to rational and irrational animals.

It is the foundation of some of the most important attainments of rational beings, such as those depending on association and habit; but its utility

is most conspicuous in regard to speech, which could not otherwise be acquired, and without which the powers of reason would be extremely limited.* Speech seems to be to thought what writing is to speech, or rather what arithmetical and algebraical notation is to common language, whether spoken or written; for without speech, the operations of the mind, particularly that of abstraction, would be extremely imperfect; nor could there be any of those extensive combinations of thought which constitute a chain of reasoning. It is wisely ordained that it should constitute one of the most favorite propensities of very early life, quite independant of reason and reflexion, and is practised almost unconsciously, sometimes even without the operation of the will, and even in opposition to it, for yawning is an involuntary spasm of the muscles of the jaw, which is frequently excited by the sight of it in others; and there is a case recorded in the Philosophical Transactions,† by Dr. Garden, of a man who, in his adult state and possessed of reason, imitated involuntarily and irresistibly whatever gestures he saw in others. It is on the same principle that we are to account for that

* See some ingenious observations on this subject, by Dr. Campbell, in his Philosophy of Rhetorick, book ii. chap. 7.

† Vol. xii. p. 112.

general similarity of external manner and accent caught unconsciously by every one from those with whom he associates.

The only objects of imitation are gestures and sounds, and through these are also transferred from one individual to another the emotions of the mind of which they are the natural expressions, and it is to this principle as well as to mental sympathy that we are to refer the following passage of the poet,—

> "Ut ridentibus arrident, ita flentibus adflent
> Humani vultus. Si vis me flere dolendum est,
> Primum ipse tibi ——————

The imitation of gestures seems, at first sight, less unaccountable than that of sounds; for it is performed by members which are objects of sight, and which would seem, therefore, more transferable to the correspondent parts of another person. Children imitate motions before they imitate sounds; and when they begin to articulate, they first attempt those letters in the pronouncing of which the motions of the organs are the objects of sight; these are the *p* and *b* among the consonants, and the broad *a* among the vowels, giving occasion to a well known etymology, from the infantile syllables expressive of father and mother in all languages.* But there are other letters and

* See this subject fully treated in the Author's Dissertations, under the article of Muscular Motion.

sounds which even animals can imitate, in forming which the organs of voice are so hidden and minute, that there can be no knowledge of what parts are put in motion in order to produce them.

SECTION II.

ON THE SOURCES OF ERROR.

A thorough knowledgeof the Animal Processes in Health the only groundwork of rational Pathology and practical Indications.—A narrow View of these Processes, and the blending of the processes of Animate with those of Inanimate Nature, the principal Causes of Vicious Theory. —The most perfect Theory inadequate without Experience.

In order to exhibit a clear and ample view of the subject about which rational medicine is conversant, the author has endeavoured, in the preceding Section, to enumerate and define the primary elements, or ultimate facts, which belong exclusively to animated nature; and which are, as it were, the alphabet of Physiology. This he has done, not only to shew the impossibility of founding practice on theory alone, but in order to impress on the minds of students the necessity of a close and unwearied attention to these truths; which, though simple and elementary, singly require considerable powers of mind to comprehend

them in their complicated relations to each other. In an attempt which is new, on a subject of which he has taken a view peculiar to himself, he does not presume to think that he has attained any thing like perfection. It is manifest however, that it is only by following out an analytical scheme of this kind (or, in the language of Bacon, by prosecuting knowledge on the ascending scale,) that a foundation can be laid for the genuine principles of scientific medicine; for it is self-evident that the elements of disease can in no other way be unfolded, but by expounding the elements of life and health. In this work, therefore, it has been his endeavour to point out how these principles may be applied in the descending scale, to the elucidation of pathology and practice.

If any benefit can accrue from a scientific knowledge of the animal nature of man, the road to it must lie through these studies, for in no other way can the proximate cause (that is, the intimate nature and actual constituent of disease) be brought to light. If our best endeavours should fail, we shall at least be warned from being misled by the past errors of others, we shall be prevented from falling into the like ourselves, and avoid the scoffs of ignorance and empiricism.

In the historical and argumentative exposition

which has been given of the powers and functions of the animal economy, his object has been to call the attention of those who embark in the profession to the great difficulties those have to encounter whose aim it is to found practical medicine on a knowledge of the laws of life; and to bespeak a liberal indulgence for those who, in attempting this, have had to grope and wander in more dark and intricate mazes, than any other labourers in the various departments of Nature.

Is it not from physiologists being unaware of these difficulties, and from their not perceiving that animal processes are utterly inexplicable on mechanical and chemical principles, that the abuses and errors of theory have been engendered and multiplied in this department of knowledge above any other, deforming and discrediting medicine as a science, and retarding its advancement as a useful art? Even as late as the beginning of last century, all medicines, and even poisons, were supposed to operate either mechanically or chemically, as appears by the works of Boerhaave, Keil, and Mead, three of the most eminent authors of that age.

It has been the author's particular study to avoid all fruitless and idle controversies (which generally turn upon ambiguities of language, or crude hypotheses,) and to adhere to a simple delineation of such facts and theories as can be clearly made out as part of the natural history of the liv-

ing frame internally, or its relation to the rest of nature externally.* Nor has he bewildered himself and his reader in agitating the question, whether life consists in the joint play and reciprocal action of the faculties he has enumerated, or in some subtle principle superadded to them. It has been his aim to avoid all such discussion, by drawing a strong line of demarcation between those truths which are matter of experience, observation, and chaste induction, and what are visionary or conjectural, resting on the former as the ultimate limit of all useful and satisfactory research, and stopping short of that barrier which the human intellect will ever be found unable to overpass. The neglect of these considerations has been, in the author's opinion so great a source of error, that he has placed it foremost in the list which he is going to propose, of the causes that have retarded and corrupted the progress of Medical Science.

It must however be confessed, as has already been insinuated, that even under the greatest possible improvement of theoretical knowledge,

* A distinction should here be made between the two words, hypothesis and theory, which by an abuse of language are too frequently used synonymously. The proper import of the former, is a gratuitous or conjectural assumption of a principle; whereas, theory in its proper sense means a principle ascertained by legitimate observation and induction.

our utmost attainments will fall short of affording the practitioner the means of exercising his art, without frequent appeals to pure experience. The most acute and philosophic mind could not duly estimate and apportion the respective operations of so many combined agents as are concerned in producing the results.

Besides positive error, one of the principal causes of the failure of those who have attempted to found practical medicine on theory, has been the limited conceptions they entertained of those principles of life which the author has endeavoured here to exhibit. Dr. J. Brown, for instance, has not taken into consideration more than two principles: another late author will hardly admit of any other cause of disease than an excessive determination of blood to certain organs: a third, and eminent living practitioner, thinks that all deviations from health are to be sought for in one branch of the assimilative process. One of the great objects of this work consists in an humble endeavour to enlarge the mind on this subject, by pointing out, if possible, all the vulnerable points of the animal frame in their various combinations. It is true that there are some diseases which are referrable only to one, or to a combination of two or three of these principles. Gangrene, for instance, ensues from a

defect of the Conservative Principle, and indigestion from a defect of the Assimilative. But there are others in which there are several of them involved, such as dropsy, and phthisis; and with regard to fevers, the most important of all morbid affections, their most distinctive character seems to consist in the derangement of all the enumerated principles. Some of these are more affected in one species of fever, some in another. In the intermittent the temperature seems chiefly affected from the alternations of heat and cold. In the typhus, and most other fevers, proceeding from a morbid poison, such as small pox, the Conservative is chiefly affected, as is inferred from the hasty manner in which the body rushes into putrefaction after death. But in every fever all the principles of life are more or less in a disturbed state, the Assimilative, Restorative, Sensitive, &c. In the stage of danger, the principle most palpably affected is the Sensorial, or Sensitive, as manifested by delirium. This has induced some of the most sagacious theorists, such as Cullen and Clutterbuck, to assign the disturbance of the functions of the brain as the proximate cause of fever. It ought not to excite surprize, that neither theorists nor practitioners should not have been sufficiently aware of the complicated nature of the causes of disease, for some of the most important and fundamental principles of life, such as

the Conservative Principle, has either been entirely overlooked, or very slightly alluded to.

In accordance with the view which has been taken of animal nature, the following scheme of the deviations from health, has occurred to the author.

1st. As these deviations consist in the simple excess or defect of those powers which have been enumerated and described.

2ndly. As they consist in the disturbance arising from their disordered state in reference to the reciprocal influence which they exert upon each other when one or more of them is in a morbid state, in virtue of that harmony and dependence which subsists in health, between every function and organ, and every other function and organ.

3rdly. As they consist in the depraved action of the various powers.

And in the farther prosecution of Medical dialectick, we have now to enumerate the various sources of error which have impeded the cultivation of our art.

1. The false references in the relations of cause and effect, arising out of the errors of the learned

in their hypothetical reasonings regarding natural agencies.

2. The false references in the relations of cause and effect, arising out of the errors of the ignorant in their assumption of supernatural, preternatural, visionary, and fantastical agencies, as exemplified in vulgar credulity and superstition.

3. The difficulty of decision, arising out of the diversity of individual constitution, whereby the judgment is misled by adopting general rules—Idiosyncrasy.

4. The difficulty of appreciating the sanative efforts of nature, and of discriminating them from the operations of art.

5. The ambiguity of language.

6. The fallacy of testimony.

7. The overweaning deference to authority and fashion.

SECTION III.

ON THE ERRORS OF THEORY.

First Source of Error. — The false reference of Cause and Effect from the errors of the Learned, in their Hypothetical Reasonings. — Fallacy of the Humoral Pathology—Misapplication of Chemical and Mechanical Science.—Examples of erroneous Theory, from the Works of Hippocrates, Galen, Sydenham, Boerhaave, and Pitcairn.—The Utility of Anatomy and Physiology vindicated.—The Question between Dogmatism and Empiricism.

Practical medicine seems more indebted to the sagacity of those who, in a rude state of society, discovered active and useful medicines, than to the early labours of the learned. From what we know of Democritus, and his followers, of whom Hippocrates was the most eminent, it appears, that the cultivation of science in the early ages of Grecian philosophy, was undertaken on the soundest principles, namely, the observation of nature, and the collecting of facts. Aristotle himself was a most diligent observer of nature, and collector of facts; but unfortunately, his logical and metaphysical writings, caught preferably the notice and

taste of the learned world, and engrossed its attention for many ages, to the exclusion of all other useful and liberal knowledge. For more than a thousand years, the syllogistic logic of Aristotle usurped the place of all literary and scientific pursuits. In those dark times, however, it was better than no knowledge at all: and I am one of those who are of opinion, that this logick, though it affords little or no assistance in the discovery of practical truths, and the interpretation of nature, is yet an excellent discipline of the understanding, tending to give precision to language and thought, and to induce habits of close attention, and patient application of mind; and that some knowledge of it can hardly be dispensed with in a liberal education. I am thankful, therefore, that it made part of the academical education which I received. The error has consisted in suffering that to usurp a predominant rank, which ought to hold a subordinate one, and in substituting the means for the end, that which was only one of the organs of knowledge being exalted to the station of its main, and almost sole constituent; and it is evident that the syllogistic form of ratiocination cannot by its nature be made available for the discovery of truth, for it pre-supposes that the proposition to be proved is already known; so that however useful it may be synthetically, in teaching knowledge and confirming truth, it must be entirely inapplicable and abortive as to what regards the discovery of new truths.

It is to Bacon,

> The great deliverer, He, who from the gloom
> Of cloistered monks and jargon-teaching schools,
> Led forth the true Philosophy,*———

that the world is indebted for dissipating the clouds of false philosophy, and for pointing out the road which led to solid learning, and the discovery of interesting truths.

His methods have respect only to physical and moral, not to mathematical truths; and the term induction, which constitutes the essence of his dialectick, is neither more nor less than a correct generalization of facts stored in the mind, and recorded by diligent observation, and practically applicable to the connection of cause and effect; differing in nothing but in degree, and superior correctness, from what is called experience in the ordinary practice of life, whether in physical or moral subjects: for the author wishes to apply this remark to those invaluable moral Essays "which come home to the business and bosoms of men."

It is manifest, that of all knowledge this is the most important, inasmuch as not only the efficiency of art, but the correct inferences on all those subjects on which the happiness, virtue, and dignity of man depends, can rest only on this foundation.

What shall we say or think therefore of those national establishments for education, in which

* Thomson.

this great department of science has been almost entirely neglected; for is it not undeniable, that in spite of the great revolution in human learning effected by Bacon, the system of Aristotle should have maintained its ground in these seminaries, almost exclusively, even to our days? And is it not humiliating and unaccountable that no regular plan of instruction has been put in practice in the universities of England for initiating youth in the philosophy either of Bacon or of Newton;* unless we except some Courses of Chemistry, Natural History, and Philosophy, in late times?

The former indeed affords a proof how necessary it is that the mind should be subjected to a long course of discipline in order to bring it into cor-

* The Newtonian philosophy, that is, the principles of Astronomy, Optics, and Mechanics, were first taught experimentally at Oxford, by Dr. Keil, a private lecturer, from Scotland. Is it not to this supineness in the national institutions that we are to ascribe the general ignorance of science in the affluent classes of society in England. As a proof of this want of taste for knowledge, we may cite the fate of an establishment in London, called the Royal Institution, founded little more than twenty years ago, for the laudable purposes not only of promoting the useful arts, through the medium of science, but to afford a most interesting recreation to the liberal classes of society. Though there is perhaps no city in the world in which there are so many persons abounding in wealth and leisure, this was found to have no attractions for them, and the Establishment is actually now on the brink of ruin for want of encouragement. In auguring the future destinies of this country, is it not to be dreaded that one of the most alarming calamities awaiting our

rect habits of thinking on matters depending on that same inductive principle of observation in the recommending of which his own chief merit consisted; for there are evidences of his being not a little infected with the credulity of the times in which he lived; and there are passages in his works which if the author were not known, would be deemed the productions of an ordinary, and even of an inferior mind. He did not entirely disbelieve in the virtues of amulets and charms; and though it is hardly possible to commend and admire this bright luminary and exalted genius too much in those walks in which he shone so illustriously in marking out the road to others, it is remarkable that he himself never engaged successfully in any experimental investigation. It is farther remarkable, that though he lived a hundred and fifty years after Copernicus, he rejected the celestial system of that great man.*

In treating of the interpretation of nature, he

posterity, in consequence of the continued increase of wealth, and of the numbers who will possess the means of living independently of labor and industry, will consist in such a degree of sensuality, frivolity, and effeminacy, as will induce a sort of Sybaritical life; and would not one of the most effectual cures, or rather preventives, of such a deplorable moral pestilence be provided, by infusing such a taste for science and literature, as would afford innocent and dignified occupation, and fortify the mind against the intrusion of groveling and vicious pursuits, to which its vacancy would expose it?

* Seen Novum Organon. Lib. ii.

certainly fell into a great error in excluding the consideration of final causes as one of the keys for unlocking her secrets. With that exuberance of imagination with which he was so richly gifted, and not without some savor of the quaintness of the age in which he lived, he says, that final causes, like the vestal virgins, are devoted to the service of the Divinity; but like them too, are unfruitful, the consideration of them not leading to scientific improvement and natural discoveries. Nothing is more certain, however, than that we are entirely indebted to the consideration of final causes for the discovery of the circulation of the blood, for it was a close attention to the use of the valves of the veins which led to it. Is it impossible, that the discouragement thrown out to the consideration of nature under this aspect, in which Bacon perhaps was not singular, may have retarded this discovery? If the anatomists who lived, long prior to this era, had contemplated the structure of the heart, with reference to final cause, they could hardly have failed to have made out the circulation, the organization of that great centre of vital movements, being, when properly considered, more striking and important in its structure and function than the circumstances of the distant ramifications of the venous system which drew the attention of Harvey.

The principle of final causes is fully recognized

by modern anatomists and physiologists, as may be seen in Sir E. Home's late articles on the digestive organs, in the Philosophical Transactions, and the Germans have invented a word *Zweckmässigkeit*, expressive of that property of organs by which they are adapted to their ends, which cannot be translated but by circumlocution, into any language with which I am acquainted. If a modern anatomist were to find in a new animal of uncommon structure, just brought from New Holland, a large muscular organ, the function of which was not obvious, he would not merely conjecture, but decide with the most confident certainty, that it performed some important function requiring powerful mechanical action, and would not rest till he found out to what purpose it was destined. This assurance rests not merely on the principle of final causes, but on one of nearly the same import, namely, that nature *does nothing in vain.* Accordingly a moment's serious reflection on the materials and structure of the heart, ought, in like manner, to have revealed the circulation to physiologists, many ages before it was detected by Harvey. Upon the whole it may be affirmed, that had the nature of final causes been duly considered, it would not have been deemed unphilosophical to have taken advantage of them as a clue for tracing and detecting some of the most secret operations of the laws of life.

Philosophers of the present age, infinitely inferior to Bacon, are in no danger of falling into the like errors; for there is a certain maturity of the human mind, acquired from generation to generation in the mass, as there is in the different stages of life in the individual man, in which respect the ancients are the young, and we are the old, as is justly remarked by himself: so that he who in these times so clearly sees the defects of Bacon, and well knows how to improve and extend his views, may be compared to the dwarf (with whom I rank myself,) on the giant's shoulders, who sees further than the giant himself. Hippocrates too, though one of the most chaste and accurate observers of nature, and collector of facts, was by no means exempt from that spirit of system which is begot by the innate propensity of mankind to assign causes, however lightly and hastily, and manifesting itself in hypothetical and gratuitous assumptions of general principles. And there cannot be a more flagrant exemplification of this, than in this great man referring all diseases to excess, defect, or vitiation of the four humours, blood, phlegm, black bile, and yellow bile. Equally absurd and gratuitous, equally disavowed by nature and observation, is the theory of Galen, grounded on the cardinal qualities of heat and cold, moisture and dryness. Nor can we quite acquit Sydenham of a like aberration from reason, in

ascribing the different species of fever to the respective humours; and that the principle of cure consisted in expelling these humours; not indeed in what he calls their *crude state*, but after they had been elaborated and prepared for expulsion by *coction*. These ideas were perfectly visionary or gratuitous, and in the present state of knowledge it would be held unworthy of a schoolboy to entertain them; unless indeed they were to be considered as a sort of metaphorical or allegorical terms, expressive of that process through which the animal economy must march in its road to health; and if it is meant by these expressions that nature ought not to be hurried nor put out of her way, by the over officiousness of art, a useful rule of practice is deducible from this theory, or rather metaphor, to point out that a part at least of the cure should be left to time and the self-workings of nature. We derive from these aberrations the benefit of warning, at least, for they serve as a beacon and safeguard against that specious but delusive simplification or premature generalization of facts, which, in our times, is considered as one of the most sure criterions of an inferior capacity, or untutored mind.

Let not what has been said be construed into a wish or endeavour to disparage and undervalue our predecessors who have laboured in the fields of science. Though the improvements in every

branch of knowledge have been indebted to the genius of individuals, who have appeared at different intervals in the history of the world, the results of their labours has depended on the stage of progress in which they found science. For it is but little that even the greatest single mind can grasp, unaided by others. The contributions and accessions which have been made to knowledge in different ages, have therefore been the work of time, as well as of genius, through which it was necessary, from the nature of the human mind, to run through a long career of error on the road to the discovery of truth. Those errors which we now affect to treat with contempt, we should have fallen into ourselves, had we lived in the times in which they were broached.

After the revival of genuine philosophy in the 17th century, it might naturally have been expected, that medical science would immediately avail itself of its light, and partake of its benefit; but this was so far from being the case, that, in the first instance, it proved a new source of error, and threw fresh impediments in the road which was supposed to be thrown open to the improvement of rational medicine. The discovery of the circulation of the blood may doubtless be considered as one of the first fruits of the enquiries into nature begun in that age. But though this is a fundamental element in the economy of the living

body, it throws little or no light on the principles peculiar to life, being purely of a mechanical nature; and abstractly considered, hardly admits of any application to the practice of medicine. On the contrary, this discovery, by its perverted application, tended to corrupt and mislead, by a loose adoption of the principles of mechanical philosophy, so well laid down in that age, by Galileo, and others. Borelli, in investigating the force of the heart by experiment, estimated it at 180,000 pounds; Hales, at 51 pounds; Keil, at 1 pound. The mechanical powers of the stomach were, about the same time, subjected to experimental research, by Pitcairn, who gravely gave out, that he found this viscus in the human subject exerted a force equal to 12,900 pounds, in compressing food in the process of digestion. Others conceiving that chemical power had the chief share in this function, endeavonred to evince, that the change in the food was brought about by means of heat and fermentation. Sounder principles have referred these changes to powers, which have nothing in common with those mechanical and chemical powers which characterize inanimate nature.*

* Dr. William Hunter, whose peculiar sagacity and precision of mind, detected at a glance the hollowness of such delusive hypotheses, and saw the danger which theorists run in trusting themselves on such slippery ground, was heard by the Author to express himself on this subject, in his publick lectures, with

But the most singular, the most celebrated, and I will add, *pace tanti viri*, the most mischievous abuse and misapplication of the principles of natural science to the animal economy, are to be found in the works of Dr. Boerhaave.

Towards the end of the 17th and beginning of the 18th century, physiologists had begun to perceive, that life was regulated by laws peculiar to itself, and that some other principles than those of mechanism and chemistry, ought to be resorted to in explaining the operations, whether of health or disease. The humoral pathology was that which prevailed in all antiquity, except in the Methodic sect, founded in the first century of the Christian era by Themison, who introduced the principle of contraction and relaxation, attributes of the solids, as the causes of diseases. Glisson and Willis, in England, Baglivi, in Italy, and Hoffman, in Germany, led the way in this reformation, in modern times, and there was a fair prospect of a more

that solidity of judgment, combined with facetiousness, which rendered him unparalleled as a public teacher, in the following terms, as nearly as his memory serves him: "Some physiologists, Gentlemen, will have it, that the stomach is a mill; "others, that it is a fermenting vat; others again, that it is a "stew-pan: but in my view of the matter, it is neither a mill, "a fermenting vat, nor a stew-pan; but—a stomach, Gentlemen, a stomach!"

legitimate system of reasoning being established. This was checked and retarded by the appearance of Boerhaave, in the beginning the 18th century. He was a man of uncommon capacity, great erudition, and indefatigable industry, and a zealous and honest searcher after what he conceived to be truth. But, probably from the habitual application to his favourite study, chemistry, he suffered himself to be deluded into what is now viewed as a most fallacious train of reasoning. This he delivered in language so imposing, and in a system so speciously arranged, that his doctrines prevailed universally for more than half a century in the schools of physick, and among the practitioners of all Europe: and it is equally astonishing and humiliating to contemplate, how the assent of an enlightened age could have been won over to a body of doctrine, so puerile and shallow.*

So heavy a censure ought not to be brought lightly against a person so celebrated in his day,

* As a general inefficiency of the art, to say the least, must have been more or less the effect of the prevalence of doctrines so fundamentally erroneous, is it to be wondered at, that in that age there should have been a disposition in extra-professional authors to ridicule and disparage the profession of physick. This was observable not only in France, but in England; (vide the Spectator *passim*) and other works, particularly the Drama. And it is remarkable that medicine was the favourite butt of three of the greatest wits of France, Montaigne, Moliere, and Le Sage.

who possessed many truly estimable qualities, and to whom science is much indebted for the improvement and diffusion of rational chemistry, and for being the first who brought the thermometer into general use and notice. In proof of our allegations, let his theory of inflammation, therefore, being one of his most important and peculiar doctrines, be tried by candid criticism and discussion.

He held that the proximate cause of inflammation, was a morbid viscidity of the blood, obstructing the course of circulation in the small vessels. The main fact brought in proof of this, was, the coriaceous crust formed on the surface of blood, drawn from a patient labouring under an inflammatory affection. This is disproved by considerations so obvious, that it is truly unaccountable that they should not have occurred to this eminent physician and his followers. For, in the first place, it does not appear in blood taken away at the beginning of inflammation, as it certainly would, if the alleged viscidity were the cause of the disorder. Secondly, The same crust appears on blood, taken from a person labouring under inflammation from a mechanical injury, such as a fractured bone: a sure proof that it must be an effect, and not a cause.—Thirdly, This crust, is merely the separated coagulable lymph of the blood, at all times present in it, and an essential constituent of

it; and when it separates itself on the surface, it is from its fluidity being encreased,* and from continuing longer in a fluid state while in the act of cooling, so far is this appearance from arguing viscidity.—Fourthly, It is found usually in blood taken from pregnant women. This doctrine of Boerhaave, had an universal currency in the beginning of last century, and materially influenced practice, as appears by the the terms attenuant, diluent, &c. applied to medicines, and introduced in conformity to the theory of the lentor of the blood being one of the principal causes of disease.†

The like judgment may be passed on this author's chemical principles of pathology, by which he referred the cause of a large class of diseases to certain acrimonious conditions of the fluids. That

* See Experimental Enquiry into the Properties of the Blood, page 57 and 116, by William Hewson, F.R.S. in which is contained some important and original observations on the influence of the blood vessels on the qualities of the blood; and he proves that strong arterial action renders the blood more slowly coagulable, giving the red globules time to subside, leaving the coagulable part on the surface, so as to exhibit the inflammatory crust.

† The writings of Huxham, and other contemporary medical writers, even those purely practical, are full of this spurious reasoning; and it is remarkable that the first editions of Pringle's Diseases of the Army is liable to the same animadversion. In the subsequent editions these theoretical notions are entirely expunged.

morbid acrimony, in various forms, does exist: that its effects are considerable in producing and aggravating disease, and that the elimination of it constitutes some of the most valuable resources of practical medicine, cannot be denied; but it is equally manifest, that, as the fluids owe their respective healthy condition to a specific organic action, their morbid changes must be brought about by the same means; that is, in almost every instance, by means entirely foreign to the processes of chemistry in inanimate matter.* We have alleged that the only exception to the vital operation of remedies are those already mentioned at page 82, in regard to digestion, the urinary secretion and concretions.

It would be unjust to accumulate on the head of Boerhaave all the pernicious errors of the chemical school. Sylvius de la Boe, of Leyden, has much to answer for on this subject. In his Praxis Medica, he so confidently assigned acids as the cause of fevers, that he acted upon this theory in practice, and it seems to be with good reason, that Pringle ascribes to this the great mortality of an

* It was in the school of Edinburgh, under Dr. Cullen, that the doctrines of Boerhaave received their chief overthrow. Cullen was the first who clearly marked out and defined the principles of life, as distinguished from those of dead matter. The Medical Society, consisting of the most eminent students, followed up this blow with great effect.

epidemick fever which broke out in Leyden, and carried off two-thirds of the inabitants.

The translation of disease from one part of the body to another was alleged as an argument in favour of the humoral theory. But it is evident from what has been stated in treating on the Sympathetick Principle, that the translation of action is as conceivable as that of a fluid; nay, more so; for these translations, as in gout, are so instantaneous, that it is much more consistent with reason to believe, that they proceed from an imponderable than from a ponderable fluid whether liquid or gaseous.

The whole of the humoral pathology rests on a fallacious and shallow, though specious foundation. Boerhaave and his followers, in their principles and practice, assumed that all alkaline bodies promoted putrefaction in the living body, and were therefore pernicious in a large class of diseases. No experiments are alleged in proof of this, and the doctrine was probably taken up on a slender and inconclusive analogy, founded on the supposed operation of chemical ferments; particularly with regard to the volatile alkali (*ammonia*), which is one of the products evolved in the putrefactive decomposition of animal substances. But it has been ascertained by the experiments of Pringle, that alkaline substances produce no septic effect on dead animal matter. Even if they did, it

would not follow that they exercise any such power over living matter. In so far as there is a tendency to putrefaction in the living body, no antiseptic can be of real avail but what tends to support the *vis vitæ* by sustaining that Conservative Principle, which, during life and health, counteracts the spontaneous decomposition of animal matter.

What is called morbific matter by Sydenham, and other theorists, consisting of vitiated secretions, ought to be regarded as the effect, and not the cause of disease. A due regard to them in practice is, however, of the highest importance; for one of the principal means of relief and cure in many diseases, consists in the elimination of acrid and vitiated secretions. But morbific matter, properly so called, that is, the matter of infection or contagion, produces its effects in quantities incredibly minute, and having excited by its specific *stimulus* a certain series of movements and changes in the solids, as happens in plague, small-pox, or typhus fever, it is no longer traceable, but vanishes and is lost sight of. This is still more palpably proved by the well known circumstances of the infection by the hydrophobic venom. There can therefore be no practical question about effecting a cure after the poison has taken effect, by the diminution of the offending matter, the only question then being how to regulate and abate the excitement produced by it in the solids.

In the progress of this excitement, the same morbific matter comes to be generated and multiplied; but neither then is the object of practice to expel it; for, not to mention the impractibility of this, the cure is effected in febrile affections by a provision of nature at the moment when, after a stated process, the morbid poison is multiplied to the utmost, and when it might, from its encreased quantity and virulence, be naturally enough supposed to be most deadly. This act of nature consists in her then rendering the subject of the disease insensible to any farther impression of the poison, as is so strikingly exemplified in the cases which recover from small-pox; and it is plain that if this did not happen, every case whatever must prove fatal

From what has been above stated, the reader will perceive the perverted views, nay, the extreme absurdity of some practitioners in Germany and Italy, who, founding their opinion on the disinfecting virtue ascribed to the mineral acids, proposed, and actually treated contagious fevers, by administering these acids, particularly the muriatic, internally. This, as they pretend, was attended with the most eminent success; but the total failure of it in the hands of physicians in other parts of Europe, has entirely dissipated this illusion. One very important inference however may in passing be drawn, concerning the essential

nature of FEVER, from the circumstance of the poison becoming innoxious towards the crisis of the disease. It is, that the phenomena of fever are to be considered as a self-healing process, whereby the system is put into a state which renders it unassailable to the further impressions of the poison.

We have seen melancholy proofs of the extreme errors into which physiologists have been betrayed, by a false and perverted application of science, in the instances quoted from Pitcairn, Boerhaave, Borelli, and Sylvius. But, though the principles belonging to inanimate matter, were to be applied with the utmost precision of correct induction, they would go a very short way in ascertaining causes, or guiding practice. It is only by touching the springs of life, that the actions of life can be regulated. The early physiologists, in all their reasonings, have almost entirely overlooked all those energies peculiar to life which have been enumerated; namely, the Generative, the Conservative, the Temperative, the Assimilative, the Formative, the Restorative, the Motive, the Sensitive, the Appetitive, and the Sympathetic, not to mention the affections of the mind.

And it is evident, that, as the actions of life must depend on the compound operation, and reciprocal influence of all these powers, those who propose to found practical medicine on their

knowledge of the laws of life, must encounter such difficulties in estimating and ascertaining the result of them, as must appal the boldest and most sanguine theorist. For, as in an algebraical problem, if any one element of the calculation should be omitted, or mis-stated, the result must be erroneous; so, if in taking our measures in medicine, due weight is not assigned to each of these influences, our practical inferences must be illusory. These sentiments are admirably expressed by Bacon in the following passage: *Subjectum illud medicinæ* (*corpus nimirum humanum*) *ex omnibus quæ natura procreavit maxime est capax remedii; sed vicissim illud remedium maxime est obnoxium errori. Eadem namque subjecti subtilitas et varietas, ut magnam medendi facultatem præbet, sic maxime etiam aberrandi facilitatem.*

The circulation of the blood, the distribution of the blood-vessels and nerves, the relative position and co-aptation of the muscles, bones, and viscera, were well known before the middle of the last century. But the existence of the lymphatic system, as co-extended with the whole body, every portion of it in its living and healthy state, whether solid or fluid, being under the unceasing action of this power, as first developed by Dr. William Hunter, and his brother Mr. John Hunter, being unknown till that period, and as this knowledge was necessary for understanding the animal machine,

professional men were in no degree qualified to account for its structure and diseased action. And who will affirm, that in the present improved state of knowledge, or even in the utmost attainable degree of it, he would be sufficiently confident that his measure of science was such that he could purely, *a priori*, act upon it with practical effeet? Could any one, though he had reached the very summit of anatomical and physiological knowledge, venture, without the utmost risk of error, to predict or control the results of actions into which there falls to be considered, not only the properties of inanimate matter, but the variously combined operations of all those properties peculier to life, which have just been enumerated, and the influence of mental affections. And when it is further considered, what a mass of credulity and error has actually accumulated in medicine, from the presumptuous attempt to grasp at such objects, and to make hasty and dangerous application of them to practice; when we cast our eyes upon our shelves, loaded with volumes, few of which contain any genuine profitable knowledge, the greater part of them composed chiefly of matter, either nugatory, erroneous, inapplicable, or mischievous, in which the dear bought grain is to be sought in the bushel of chaff, may it not be questioned, whether such researches have not tended more to retard and corrupt, than to advance and improve practical medicine?

Those who are disposed to depreciate the practical value of anatomy, might allege that there are several of the most important functions, upon which the knowledge of the structure of the dead body, though ever so minute and perfect, could throw little or no light; nay, that there are some morbid circumstances and indications in the living body, ascertained by empirical observation, in which mere anatomy is more apt to mislead than instruct. For example, it is known from experience, that impressions made on the external surface of the body, have a decided effect upon the subjacent *viscera*, though there subsists no anatomical relation between them: thus cold applied to the external surface of the thorax or abdomen, will more readily excite inflammation or spasm in the lungs or bowels, than in other parts. And in curing inflammation of these *viscera*, the abstraction of blood from the adjacent surfaces, will, as we learn from experience, have much more effect than a bleeding from the system, though there is no anatomical connection between these parts; that portion of the circulation which is in the skin, being as remote from that of the subjacent lungs and intestines, anatomically considered, as any other part of the body. The like may be said of the application of blisters and local rubefacients. It has also been alleged, by the disparagers of anatomy, that even for the purpose of detecting the seat of diseases after death, the information obtained is

extremely limited, or altogether fallacious; for whether it be from the morbid affection existing in one organ, and the sensations from sympathy being in another; or that the symptoms of disease are different in different constitutions, or from its not being possible to decide what morbid appearance has been the cause, and what the effect of the disorder, it so happens that those even who are most practised in morbid anatomy, are in numberless instances deceived as to the pre-conceived nature and seat of the disease, as investigated by dissection; so that often little other instruction is acquired than a lesson of modesty, and of distrust in ourselves.

Are we then to admit, that the greater part of what we have been taught at the schools of physick, and of what we have read, or may read, in books, is in no wise conducive to our practical improvement?—Far from it, for

1st. Though anatomy, physiology, and pathology, should be proved to be of little or no avail, nay of pernicious tendency in the practice of physick, the acquisition of these branches of education is nevertheless indispensable, in order to appreciate their value, and in order to be armed with antidotes against the influence of fallacious theories, and to obtain the guidance of true beacons, instead of false lights. There is nothing better known to

those, who are conversant in medical practice, than that the most ignorant and shallow, those of the least learning, nay those of no learning at all, are the most addicted to hypothetical reasoning, the most infected with presumption and self-conceit.

The only means, therefore, of guarding ourselves from being misled by false theories, or by the misapplication of those that are true, is to gain a thorough acquaintance with both, whether originating in learning or in ignorance. I say *thorough*, for the philosophic poet in stating the beneficial influence of a liberal education on the practice of life, does not say simply *didicisse*,* but FIDELITER *didicisse;* that is thoroughly, and in good earnest. In a word, we should strive to attain, if possible, that only criterion of substantial and profound knowledge, that of *knowing how little we know.* This is the only cure for overweaning vanity and self-conceit, and the only standard by which we ought to measure our own intellectual attainments and those of others.

2dly. The knowledge of Nature, in all its branches, is an indispensable requisite in the cultivation of the mind. It is highly useful, were it only as a gymnastic exercise of the understanding, a

* Ingenuas didicisse fideliter artes,
Emollit mores nec sinit esse feros. OVID.

mental *palæestra* as it were, consisting in that salutary discipline of the faculties, implied in the acquisition of habits of attention, and the practice of the reasoning powers. For this we have the authority of Cicero, who says, " Est animorum ingeniorumque quasi pabulum consideratio contemplatioque naturæ:" and Mr. Burke, an authority hardly inferior, in descanting on the subject of education, says that " by such exercise the mind is opened and enlarged, and though the game may be lost the chase is of service." Besides, all arts and sciences have a bearing on each other; and the history and philosophy of animal life, is surely as necessary an accomplishment to a physician, as any other branch of science or literature; and we should be tempted to think, from this sense of the word *physician*, being peculiar to our language,* that this notion especially prevailed in England.

The study of nature is surely the most salutary of all intellectual exercises in the practical arts, particularly that of medicine, inasmuch as it comprises the knowledge of the physical agencies, about which it is conversant. Mathematical acquirements are here comparatively but little applicable; for, the relations of quantity, about

* This word in French and other languages, means a person versed in natural philosophy.

which the exact sciences are conversant, do not apply to the laws of organic beings, and is a process of thought quite distinct from that which is termed inductive, employed in the investigation of nature.*

It is the remark of a modern philosopher, eminent for his just and profound views,† that all *observation* is founded on *comparison*. He might have added, that all deductions, whether in practical life or in physical science, are grounded on it, corrected and extended by it. It follows, that the wider is the range of comparison, the more numerous are the truths that may be elicited. And as all practical researches ought to consist of an induction of facts, single objects or events, are of little value in their insulated state, and can only be available in so far as they stand related to other objects and events; for it is by varying and continuing these, and in comparing them with others, that useful facts and inferences are attained, and by which it can be ascertained whether they stand in the relation of cause and effect, or are merely casual co-incidences, or common effects of the same cause. Those physical agencies,

* See an Essay on this subject in the Philosophical Transactions, vol. xlv. page 505, by Dr. Reid, of Glasgow; also Mr. Jardine's Outlines of Philosophical Education.

† Dr. Adam Ferguson, in his lectures on Moral Philosophy, which the author attended in the session 1766-7.

on the discovery of which all practical knowledge is built, and those analogies in which all rational suggestions and conjectures originate, can only be established by such enlarged views of nature, as enable us to arrive at truths, and adapt means to ends, and may be considered as at once the light and the instrument by which we work, whether in art or science. And as knowledge requires time and accumulated experience for its maturity and correctness, we are not to wonder at the absurd theories of our ancient masters, Hippocrates and Galen, nor the delusions of astrology and alchemy, with which the more early moderns were infected, all which can be eradicated only by a thorough knowledge of the genuine powers of nature.

3dly. The habitual meditation on natural causes, tends to banish superstition, and to abolish the frivolous practices riveted in ordinary minds by early impressions and imposing authorities, or sanctified by immemorial usage and tradition. These illusions are found to prevail not only in rude ages, but in those of considerable civilization; for, besides amulets, incantations, and various other supernatural influences, certain practises, hardly referable to any ascertainable agency, either natural or supernatural, have prevailed in all ages. We find it, for instance, stated in very good Latin, by authors who flourished not more than 150 years ago, on the fanciful prin-

ciple of what is called signatures, that turmerick is good for the jaundice, because it is of a yellow colour; that fox's lungs are good for the asthma, because that animal has strong powers of respiration, as is proved by the long and hard run he makes when hunted; that the testicles of the wild boar, reduced to powder, are good against barrenness, and kidney beans against diseases of the bladder; and that the root of the orchis,* was indicated by its shape, to be a promoter of procreation. And have we not seen in our own times, persons of liberal education, of both sexes, who could persuade themselves that certain unmeaning motions of the hand, called magnetising, could exert sensible and salutary influences upon persons, however distant? But these need no longer blush for themselves, when they are told that some of our early instructors in the laws of nature, were nearly as absurd. Bacon did not disbelieve in amulets and magic; and it appears from several passages in his works, that he believed in sorcery;†

* "This doctrine of signatures was avowed by Dioscorides and Pliny, among the ancients, and after the restoration of learning, not only by that maniac Paracelsus, but by later writers, who maintained that it was conformable to principles of reason and religion, that remedies should be stamped as it were by the seal of the Almighty, as visible indications of their virtues. It is hardly necessary, in answer to this to say, that it is equally untrue in fact, as it is at variance with the ordinary administration of Providence and the analogy of Nature.

† See Vid. Histor. Natur. Centur. I. 27. Histor. Natur.

and Boyle seriously recommends the thigh-bone of an executed criminal, prepared in a prescribed manner, as a remedy in certain disorders. Nor can it be doubted, that practitioners would still be liable to fall into the like weaknesses, were they not, as they now are, well disciplined in the study of the laws of nature, and habituated to the contemplation of her genuine agencies. The effect of the study of nature, in thus counteracting superstition, is no where, that I know of, so well expressed as in these lines of Virgil, so familiar to every school boy, and though so frequently quoted, they convey such sound good sense, that however trite they may be, they never can be stale or inapplicable:

> Felix qui potuit rerum cognoscere causas,
> Atque metus omnes et inexorabile fatum,
> Subjecit pedibus, *strepitumque Acherontis avari.*

Those minds which are habituated to the contemplation of nature, are also armed against that frequent fallacy, whereby two events appearing casually conjoined in time and place in a few instances, are believed to stand in the relation of cause and effect. It is upon a similar logical fallacy, that the moral of the fable of the fly on the wheel is founded.

Centur. x. 980. Is this to be accounted for by his complaisance to his sovereign, who was a firm believer in witchcraft?

Men of great capacity, and high mental attainments in widely different departments of knowledge, also men of dignified stations, the heads of the law and the church, but who had not given their minds to such pursuits, have been known to become converts to the most grovelling imposture, and dupes of the vilest quackery. When to these considerations it is added, that the fair exercise of judgment is impeded by the inordinate love of life, and fear of death, among those in the full possession of their faculties; that it is not only impeded, but impaired in those who are under the influence of sickness; and when it is farther considered, that great allowance is to be made for those who become impatient from protracted sufferings unrelieved, and perhaps irrelievable by human skill, we shall be at no loss to frame an apology, nor find it difficult to account for persons of the best understanding, being occasionally betrayed by their own credulity, or that of their importunate and well-meaning friends, into the most irrational practices. In short, when we reflect how deeply interesting life and health are, particularly to the affluent, and that they engage the hopes and fears of mankind so anxiously, as to pervert the judgment of the most enlightened, the popular misconceptions on this subject ought rather to be matter of pity and regret, than of surprise, indignation, or derision. It may farther be urged in

favour of secret medicines, provided they are harmless, that in incurable cases, they keep alive hope, a circumstance of no mean importance, particularly in long protracted illnesses, such as the *phthisis pulmonalis*, in which many unavailing means have been tried, and in which the mind of the patient might otherwise be plunged into the horrors of despair.

4thly. Though physiological and pathological researches, even the most correct, have had little share in suggesting active and useful remedies, the greater part of these having been discovered in dark ages by fortuitous incidents, or in more enlightened ages by analogical reasoning, yet hypotheses, though ever so visionary, afford useful suggestions. It is also very remarkable, that hypotheses, or theories, as they are more commonly called, though widely different, do often wonderfully coincide in matters of practice with each other, and with well established empirical usages, each bending and conforming, in order as it were to do homage to truth and experience. It has been remarked, that Boerhaave, in following out his fanciful and erroneous views of the animal economy, stumbled upon some practices, the utility of which were sanctioned by experience. For example, he dissuaded from the use of sudorifics, and strong purgatives in pleurisy, from the consideration of their carrying off the most liquid part of the blood,

leaving the remainder in that state of spissitude, in which he conceived the proximate cause of inflammation to consist. This is sound practice, however exceptionable the theory may be. He believed that the blood owed its red colour to iron, a doctrine found, by future chymists,* to be erroneous; and with this in view, he strongly recommends the internal use of this metal in chlorosis, and other cases of chronic debility, in which there is an evident deficiency of red globules. Though this remedy does not act on the principle which suggested it, it has, nevertheless, been found to be a most efficacious plan of treatment in these disorders. Some of Sydenham's theories, such as those of fermentation and coction, have appeared so fanciful, so abhorrent to nature and sound philosophy, that it has been said, that if any one were to utter nonsense for a wager, he could hardly surpass what this eminent physician has gravely delivered on these subjects. Nevertheless, as his expressions may be received as metaphors or allegories, fermentation and coction being obscure conceptions, or shadows as it were, of those processes, types, and crises, which actually exist in nature, they are not so foreign to truth as they appear to be in their proper and literal

* See an Article in Phil. Transactions of 1797, by Dr. Wells, another, ibid, of 1812, by Mr. Brande, also the works of Vauquelin.

acceptation, and admit of an application practically useful, as has been already remarked. Such suggestions as those of Boerhaave are at least preferable to trials made at random, and are fairly admissible, if duly tested by experience.

5thly. It must be obvious to every reflecting mind, that those who have made themselves acquainted with the various organs and functions engaged in the animal economy, must have a great advantage in practice over the unlearned empirick, in discriminating the morbid affections from each other, and in varying accordingly the respective means of relief. For instance, a physiogist and anatomist, from his knowledge of the intimate nature of morbid affections, the difference of their seat, and other circumstances, is able to distinguish spasmodic from inflammatory pains, a distinction which would not readily occur to an uncultivated observer, but of the most vital importance in practice; for the remedies required for the relief and cure of a spasmodic pain in the stomach and bowels, demands a treatment, not only different, but opposite, to that which proceeds from inflammation. It is only anatomical and physiological science that can exhibit to a practitioner a clear and vivid conception of these and other distinctions essential to the safe and efficient treatment of diseases.

6thly. Whatever doubts there may be with regard to the degree in which anatomy is useful in physick, there can be no doubt of it, with regard to surgery, in which an accurate knowledge of the relative position and structure of organs is indispensable.

Finally, the state of health ought to be fully known, as a standard by which to measure the magnitude, as well as to ascertain the nature of disease, as is well expressed in the following passage from Galen: *Cujusque morbi tanta est magnitudo quantum a naturali statu recedit—quantum vero recedat is solus novit qui naturalem habitum ad amussim tenuerit.*

But if the benefits, derivable to medicine from physiological science, are so limited, from what other and better source is improvement to arise? The answer is—from accurate observation; in other words, from enlightened empiricism. It seems an abuse of words, to restrict the term *science* to physiology and pathology, and to withhold it from those processes of the understanding, by which practical truths are ascertained, facts accumulated, and useful inferences deduced from them, constituting OBSERVATION, which in this sense is synonimous with induction. Shall we dignify with the title of Science, the absurd positions of Pitcairn, the puerile and shallow hypotheses,

of Boerhaave and Sylvius, and deny it to those solid and applicable discoveries, the fruits of chaste observation and sober experience, ascertained by those methods of induction which it was the great aim of Bacon to recommend, and his great glory to introduce, as the sole parent of legitimate, substantial, and useful knowledge? On the contrary, the truth seems to be, that a higher order of intellect, a more rare and happy genius, a more correct and better tutored understanding, are required to elicit practical truths by observation, than to invent theories, or rather hypotheses.

By empiricism, is vulgarly understood that knowledge of the virtues of divers medicines, which are supposed to have been ascertained by experience, as applicable to their respective maladies. A few of this description might be named, such as mercury in the venereal disease, fox-glove in a large proportion of cases of hydrothorax, sulphuric acid in night sweats, the meadow saffron in most cases of articular gout, iodine in glandular swellings, and above all, the citric acid in sea-scurvy. It is to be wished that there were more of these, and probably a great part of the future improvement in practical medicine will consist in the discovery of specifics. Perhaps they are treated too superciliously by scientific physicians, as being nearly allied to empirical practice in the oppro-

brious sense of that word. But the exhibition of these and the like remedies, constitute as yet but a very small proportion of the whole practice of medicine. The number, variety, and complication of disorders, are such, that the most acute exercise of judgment is called for to discriminate cases, to adapt the treatment to the indefinite diversity which occurs in actual practice, and to ascertain the most advisable methods of cure, all which can only be effected by applying the rules of induction, that is, of enlightened empiricism, together with such lights as can be gathered from chaste and sober theory.

We have already more than once adverted to that profound wisdom displayed in the constitution of our mental faculties, whereby they are made responsive to the constitution of external nature, in the same manner as our senses; and that this is strikingly exemplified by the susceptibility of the human mind to those associations and habits which arise out of the repetition of events durably connected together by the constancy of the laws of nature. Unless these were indelibly imprinted, or recorded, as it were, in the mind during the early stage of our existence, life could not be maintained, all those instincts, by which we pursue what is salutary, and eschew what is noxious and dangerous, being founded on this principle. The avoiding of fire, and of precipices,

the collision of hard and pointed bodies, may be quoted as examples of this. As the passive associations, in which the habits of childhood consist, forming the link between the faculties of reason and mere animal instinct, correspond with those objects and events occurring in the course of nature, so by the same scheme of final causes, the exertions of mature reason, indispensable in more advanced life are improved in rational beings by frequent repetition, and form the basis of that practical promptitude and felicity in which the exercise of art consists. And what is called sagacity in the adult stages of life, is a sort of approach to, or imitation of the intuitive faculty of infancy; but, instead of being the immediate suggestion of nature, it is acquired by cultivation; so that by practice we learn to connect cause and effect, means and end, operations which, in well turned minds, are performed with promptitude and precision, by interpreting fairly the appearances of nature, and stripping them of those adventitious fallacies which mislead ordinary minds. In order to attain this, there are required an appropriate natural capacity, the good fortune of not having been beset with prejudices in early life, an habitual exercise in the observation of nature, a candid and ingenuous disposition, an ardent love of truth, an exalted sense of duty, a deep insight into human nature, a large store of facts in a correct and tenacious memory, the power of combining, comparing,

and discriminating these, by an intuitive glance, in the moment of applying them to the practical end in view. This is what is understood by the term *tact*, in English and French, εὐστοχία, in Greek, being that faculty by which practical facts are decided on, and is performed by an instantaneous, silent, and almost unconscious calculation and induction, to be met with only in minds, at once happily constituted and highly cultivated.

From this it will be seen, how vain all acquired knowledge is, without practical habits; for in the liberal, as well as in the mechanical arts, expertness can be attained only by frequent and long-continued exercise of actual labour: and it is by a happy and appropriate figure, that those who become skilled in languages, painting, eloquence, physick, or the common business of life, are said in Latin, *callere*, whence *callidus*, words derived from *callus*, that is, a horny substance formed on the hands of mechanical artisans, by long and unremitting labour. In whatever attainment we aim at, whether mental or manual, there is a certain expertness in the exercises of the mind, as there is a dexterity or slight of hand in mechanical operations, attainable only by that long assiduous and exclusive application which alone can beget efficient practical habits.

For this reason, all the subsidiary and ornamental branches of education should be got over in early life, in order that there may be full scope for the acquirement of that useful knowledge in which the exercise of professional talents consists, when we come to be engaged in the grave and serious pursuits of life. For the mind of man is so framed that, except in the case of a prodigy, it cannot excel in more than one practical art; so that it becomes matter of conscientious duty to concentrate the whole powers of attention on that single object. So true is it, according to the common apothegms, that *practice only can make perfect*, or that *Jack of all trades is good at none;* or let us draw a more dignified illustration from Cicero, who says, *Nec* MEDICI, *nec imperatores, nec oratores, quamvis artis præcepta perceperint, quidquam magnæ laudis dignum, sine usu et exercitatione consequi possunt.* Was it not clearly the intention of the author, in placing physicians here in the foremost rank, to intimate, that, of all professions, the most severe discipline of practice and experience, was required in physick? For it would be presumptuous in us to think, that he meant by placing us first, to concede to us the precedence in dignity over generals and orators. This collocation of words might be merely for the sake of euphony, so studiously cultivated by our author, or may-be a climax in which he means to assign us the lowest post. Be this as it may, our best thanks

are due to this great statesman, orator, and philosopher, for admitting us into such good company on any terms, after what has been said of us, by Dr. Conyers Middleton, in his disssertation *De servili conditione Medicorum apud Romanos.**

From all that has been said, we ought to be in some measure qualified to come to a decision on the celebrated question of the comparative merits of the empirick and dogmatic methods of cultivating physick. It seems pretty evident, that if either method were employed exclusively, or carried to an extreme, the art of physick would suffer, both in its efficiency, and its prospects of future improvement. It has clearly appeared, that, under such a complication of causes, influencing the operations of life, it would be utterly hopeless to decide any point purely and strictly, *a priori*, and that it is absolutely necessary, that experience be

* I cannot resist transcribing here the opinion of Mr. Locke on this subject, in the impressive language so characteristic of that great author. "Would you have a man write, or paint, or dance well, or perform any other mechanical operation; let him have ever so much vigor and activity, suppleness and address, yet nobody expects this from him unless he has been used to it, and has employed time and pains in fashioning and forming his hand or other parts to these motions. Just so it is in the mind. Would you have a man reason well, you must use him to it betimes, exercise his mind in it, observing the connexion of ideas, and following them in train."

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called in as an aid and a test to the inferences of theory. On the other hand, a blind empiricism would be found deficient, without that discrimitive judgment, founded on an acquaintance with the laws of life, and without those enlarged and correct views of general nature, by which the excesses of credulity and of scepticism are equally repressed. This question was much agitated in antiquity, and is most ingeniously, eloquently, and judiciously discussed by Celsus, in the preface to his excellent work. He evidently leans to the side of empiricism, which, in the very crude state of anatomy and physiology in that age, certainly argues his good sense; but he by no means explodes the study of the structure and functions of the body, as of no practical utility, and concludes with the following recommendation, or rather apology, for dogmatism: "*Ista naturæ rerum* "*contemplatio, quamvis non faciat medicum, ap-* "*tiorem tamen medicinæ reddit.*"

The conclusion therefore upon the whole is, that these two methods ought not to be regarded as adversaries, but as allies; and that good sense will consist in excluding neither, but in fairly appreciating what is due to each.—This is a compromise congenial with that which the poet proposes between Genius and Study:

— Ego nec studium sine divite venâ,
Nec rude quid possit video ingenium, alterius sic
Altera poscit opem res, et conjurat amice. Hor.

Before quitting this part of the subject, it is important to repeat and inculcate that the great benefit of rational medicine, consists in establishing a correct tie between cause and effect, more especially in strongly discriminating between actual agency and mere concomitancy. This principle may be illustrated, by adducing the strong case of a conceivable mistake which an ignorant person might make on the barometer. In this instrument the rise and fall of the quicksilver is accompanied by certain changes in the weather, of which the changes taking place on the height of the mercury in the glass is the criterion; but a criterion as inseparably connected with the changes in the atmosphere, as if they stood in the relation as cause and effect; so that the ignorant person might propose to change the weather, by forcibly raising or lowering the mercury. This absurd, as it appears, would only be reasoning on the same principle as many do, who draw inferences in physick from certain symptoms which appear and disappear simultaneously, without exerting the least real agency on each other. It is, in short, the error which the physician falls into, who *prescribes for a symptom:* for example, quickness of pulse is such a constant attendant on fever, that it has been considered as a constituent, and not a symptom; a cause and not an effect; and it has been proposed and practised, to give digitalis on the indication of

retarding the pulse. I never could discover any virtue it possesses in abating real fever. The analysis of the word *symptom*, will further elucidate the author's meaning. It is a literal translation of the word co-incidence, the one borrowed from the Greek, the other from the Latin. And as it ought never in strict language to be used in any other sense than as a concomitant circumstance, making no part of the essense of a disease, it is an abuse of language, to apply it as making part of a definition or characteristic of the disease, as is frequently done. To do so is a solecism in philology as well as a sophism in logick.*

* I have lately met with a passage in one of the articles of a work, entitled Transactions of the Royal Asiatic Society, Vol. i. on the Learning of the Hindoos, by that eminent mathematician and philosopher, Henry Colbrooke, Esq. and as it has relation to the present subject, the reader will excuse the insertion of a quotation from it, being a curious specimen of the ancient Hindoo literature, which among other branches of Science, embraced that of logick. It is as follows: "In our judgment, there are three sorts of inferences. 1. The inference of effect from cause. 2. The inference to cause from effect. 3. That which has no relation to cause and effect. They give as an example of the first, the anticipation of rain from a gathering cloud; of the second, the conclusion that fire exists on a hill from whence smoke is seen issuing; the third is exemplified by the presence of the colour of a particular flower being inferred from its peculiar odour; or the saltness of the sea from a specimen of its water; or that all the mango trees were in bloom when one is observed to be so.

SECTION IV.

SECOND SOURCE OF ERROR.

Ignorance.—Superstition.—Credulity.—Perverted Interpretation of the Operation of Nature.—Fantastical Remedies.

THE evils resulting from the hypotheses and false theories of pretended science, having been fully exposed in the last section, the next subject for consideration in the order laid down, is the errors arising out of ignorance, superstition, and credulity. It is not the learned alone however, that we have to accuse of the errors of theory. The most vulgar and ignorant, as already remarked, are found to be as often guilty of the abuse of theoretical reasoning, as the pretenders to science. This abuse is generally grounded on the hollow foundation of the humoral pathology. For example: it is a natural enough idea to arise in an uncultivated mind, that the matter of the small pox is a foul humour in the blood, and that the cure must therefore consist in the expulsion of this humour, and that *it stands to reason,* (as their phrase is) that this is to be effected by bringing it to the surface of the body in the form of pustules,

through the means of stimulant medicines and food, close warm apartments, and loads of bed clothes. It is needless to say in the present stage of medical knowledge, that, nothing can be more false in theory, nor more pernicious in practice, than this doctrine, which however was acted upon for ages, inflicting agonising death on millions of human beings. Nor was it till the seventeenth century, that this cruel fallacy was detected by Sydenham and other physicians.

The like instruction is derivable from other passages of medical history. A very apt one in recent history, occurs in the prejudices which have been entertained against the use of the colchicum, as a remedy in articular gout. They say here also, that *it stands to reason* that the gout, being a sharp humour thrown on the extremities by the kindness of nature, it would be absurd to repel it from thence, and throw it on vital parts, or perhaps contaminate the whole mass of blood and humours. These arguments are so plausible, that they seem almost unanswerable to many persons of good understanding, not belonging to the profession, and perhaps to some belonging to it, even in this age of superior light. But nothing is more certain, than that the matter of small-pox does not exist in the blood, but is produced by a morbid secretory action on the surface of the body, and that the greater the quantity produced, the

more violent and dangerous is the disease. And with regard to the gout, it equally admits of proof that it is not a homour, but a morbid action; and that whatever humours or concretions there may be in the seat of pain, these are effects and not causes; and though the fact of its being translated seems on a superficial view, to favour the supposition of a humour, it is well known that in the animal economy, actions are as capable of translation as matter; nay more so; and that the translation of the gout is sometimes so instantaneous, as to be accounted for only on the supposition of its being an action. The operation of the remedy in question, therefore, is merely to abate the morbid action, without any tendency to throw it on vital parts, and is found to be a safe and effectual means of relief and cure, with such exceptions from peculiarities of constitution, as are incident to all other remedies and methods of treatment.

From these and other instances which might be adduced, it is evident that the vulgar and illiterate are as apt to form theories as the scientific; and the author will appeal to every person of good understanding, belonging to the profession or not, whether the theories of the learned or of the ignorant are likely to be most pernicious; and laying aside all theory, whether the plain and unerring road of experience, is not more likely to be followed by a cultivated than by an uninformed mind?

But the most common aberrations of ignorance, consisting in the false references of cause and effect, are imputable to superstition and credulity, which we now proceed to consider.

As most diseases, particularly calamitous epidemics, were supposed, in rude ages, to proceed from the anger of the gods, the remedy naturally suggesting itself was the means of deprecating them. Sacrifices, even human sacrifices, were resorted to in times of Paganism: processions, and other religious observances in the Christian world.

Under the head of Superstition, may be ranked fatalism; for it follows from this dogma of faith, that all means of averting predestined events, that is, all future events whatever, are not only unavailing, but impious. It is manifest, that if this were consistently adhered to, every effort conducive to self-preservation, or even the common comforts and accommodations of life, would be paralized; there would be an end to all the pursuits and duties of social life; nay, to the very existence of the human species. Though this speculative principle, however, has never been able entirely to overpower and extinguish the feelings and dictates of nature to this extent, except among a few fanatical maniacs, there are proofs enough in the history of mankind, of its pernicious prac-

tical effects. One of the most conspicuous examples of this, is found among the professors of the Mahomedan faith, in their abstaining from the means of stopping the progress of the plague. Among Christian sects, professing this doctrine, the like evils have arisen in an inferior degree, as exemplified in the opposition which the inoculation of the small-pox met with from this religious prejudice.

But besides religious dogmas, there are other evils arising out of false conceptions of the Supreme Being, and the belief in the existence of invisible powers. One of the most remarkable of these, is sorcery. This was not unknown among the nations of antiquity, as exemplified in their omens, augury, and incantations; and Virgil distinctly alludes to what is called the influence of an evil eye.* But what is commonly understood by witchcraft, is peculiar to Christian countries, for it is founded on the supposed interposition of the Devil and his imps, beings unknown in *Pagan* mythology. It has accordingly prevailed in all ages and countries of christendom; but it does not seem to have prevailed so much in any time or place, as in England and Scotland in the 17th century, notwithstanding of the light of the reformation. This was probably owing to the sanguinary laws enacted against witches, in the reign of

* Nescio quis teneros oculus mihi fascinat agnos. Eclog. 3.

James the First, who was so inveterate an enemy to these imaginary beings, that he procured a sentence against a book in which their reality was questioned, to be burned by the hands of the hangman,* and demonology was one of his most favou-

* During the whole of that century, there were innumerable executions, or rather judicial murders, of those who were accused of sorcery, chiefly old women. It is related in Howel's Letters, a work of considerable authority, (the more so, that the author himself believed and approved all he recounts) that in the year 1646, two hundred persons were tried, condemned, and nearly all executed, for witchcraft, at the assizes for Suffolk and Essex. And the same author, in a letter dated 20th of February, 1647, says, that ever since the civil wars commenced, the crime of witchcraft was extremely prevalent, both in Scotland and England, particularly in the two counties of Essex and Suffolk, in which three hundred had been tried and convicted since the beginning of these wars, and more than one half of them executed. And at the assizes held at Chelmsford, 1662, at which the pious, learned, and virtuous Sir Mathew Hale presided, several persons were sentenced to death and executed on the same charge. He founded his sentence chiefly on passages in the holy scripture. At Paisley, in Scotland, five persons were tried and burnt alive on the like accusation, in the year 1699. After this period, this persecuting rage rapidly abated, but was not quite extinguished till the following century. There is a trial and conviction recorded at Dumfries, in the year 1709, but the punishment was mitigated to banishment. The most horrible tragedies were acted in New England in the end of the 17th century. The last instance of capital conviction that occurred in Britain, is that of a woman in Sutherland, condemned to death and burnt alive, by the sentence of the sheriff of that county, as late as the year 1722. The laws against it were repealed in 1736, and the belief of it is now confined to the dregs of the people.

rite studies. Is there to be found in all history, except in the annals of the Inquisition, incidents which for their absurdity and cruelty, are so disgraceful to human nature, so disgusting, humiliating, and deplorable, to every liberal, enlightened, and feeling mind? There is this singular difference between the inquisitors and the judges who sat upon witches, that the former, in addition to their religious zeal and persuasions, were under the influence of ignorance, and were instigated by sordid and black passions; whereas the latter, were men who acted from conviction, but were of minds enlightened and liberal on all other subjects, and were actuated by the purest intentions. In those times, almost all diseases attended with uncommon appearances and long continued, were imputed to witchcraft. Convulsive diseases, such as epilepsy, were particularly liable to this suspicion. The belief in sorcery and apparitions, gave rise to the invention of exorcism, charms and amulets. And there can be no stronger proof of the power of habits on the human mind in early life, than the difficulty which men of the best understanding find in shaking off the erroneous impressions of childhood, a circumstance which ought to induce all parents to avoid or counteract them by education.

There are innumerable other examples of persuasions and practices, in every country and in

all ages, founded on ignorance and credulity, not strictly referable to superstition: inasmuch as they do not presuppose the interposition of invisible supernatural powers, but only a perverted interpretation of the ways of nature. Of this kind, are not only many irrational practices in our own country, but such as are well authenticated in all the accounts we have of the customs and manners of all remote nations, from the most savage to those of considerable civilization.* In quoting examples of these, the first I shall mention, was a very common practice in Europe in the middle ages, of applying dressings in the case of wounds, not to the injured parts, but to the weapons which inflicted them. This, and similar absurdities, were countenanced and encouraged by a set of mysticks, called Rosicrucians. According to this method of cure, neither the wound no r the dressings were to be disturbed for seven days. And in many cases, this would be more successful, than the too officious practice of more enlightened times; for it is conformable to what the still more improved principles of modern times dictate, namely, to give a certain scope to nature in the cure of recent wounds and surgical operations, by allowing time and rest for the process of healing by the first intention.

* Some of the most recent of these, are to be met with in Sir J. Malcolm's Account of the Customs and Manners of Central India; and in Captain Lyon's Account of the natives of the Polar Regions.

The next example I shall adduce is from our own times. It is hardly less absurd than the last, and does not admit of the like palliation. I mean what is called animal magnetism, to which many became converts, whose education ought to have placed them above being the dupes of such barefaced imposture. There is nothing contrary to the nature of things that invisible effluvia from one living body should affect another living body at a small distance, provided it can be made out as a matter of fact; but as the effects of it may all be accounted for from the influence of imagination, and as it has been pretended, that the operation of it can be conveyed through an indefinite space, it is impossible not to place it in the list of those delusions which operate through strong *faith* and *fancy*. And after what has been said of the credulity of Bacon, and other men of the highest intellectual endowments, it can be no matter of surprise that this delusion should still exist among some persons on the continent of superior education. The like advantage has been attempted to be taken of public credulity by the pretension of ascribing a sanative virtue to metallic tractors. The fallacy of animal magnetism was fully exposed by a Committee of the Royal Academy of Sciences of Paris, in the year 1783, of which the celebrated Dr. Franklin was a member; and an equally satisfactory detection of the other was made by Dr. Haygarth, at Bath, a few years ago.

Sir Theodore Mayerne, a native of Switzerland, who possessed all the medical erudition of the age in which he lived; that is, the first half of the 17th century, was physician to three Sovereigns of England, was held in the highest estimation at court, and had, during that time, by far the greatest practice in this metropolis. We find among his remedies, the balsam of bats for hypochondria, remedies taken from certain parts of adders, sucking whelps, earthworms, &c. We find also, as articles in his materia medica, the secundines of a woman in her first labour with a male child, the bowels of a mole cut open alive, mummy made of the lungs of a man who died a violent death, and other articles equally ridiculous, besides various amulets.* We are, nevertheless, indebted to him for the first introduction of calomel, and other valuable remedies; for he introduced a considerable share of chemical and pharmaceutical knowledge into England; and some valuable practical observations are to be met with in his works. The anointing and bandaging of the weapon with which a wound has been inflicted, and the Royal touch, which have been already adverted to, may also be quoted as instances of the like irrational, though not pernicious, practices. And the virtues of certain wells, dedicated to particular saints to whom they were supposed to owe these virtues, are referable to the

* See more examples at page 160.

like principle; for the chronic heats of the skin, for which they were chiefly recommended, are found to be equally benefited by any other cold spring.*

Superstitious and fantastical practices ought not therefore in all cases to be disregarded. The rust of Telephus's spear, mentioned in Homer, as a cure for the wound it had inflicted, was probably the *ærugo æris*, the weapons in those days being chiefly made of brass; and this is found by modern experience to be one of the best applications for cleansing sores, and disposing them to heal. The inoculation for the small-pox, in Turkey and Wales, was practised on a superstitious principle, long before it was introduced as a regular practice into this country. The superstition consisted in buying it; for the efficacy of the operation in giving safety, was supposed to depend upon a piece of money being left by the person who took it for insertion. And it is not a little curious, that the same practice should have existed in countries so remote.† It may farther be remarked, that such is the power of imagination, (as will be more fully adverted to in a subsequent part of this work,) that the most inert substances, and the most inefficient

* See a Work on this subject by Dr. Rigby, of Norwich.

† See Annual Register, vol. xii. 1769, page 80-85, and Russel's History of Aleppo.—See also some interesting remarks on the practice of Savage Nations, in Professor Stewart's Elements of Philosophy of the Human Mind.—See also various superstitions recorded in the works of Etmuller and Cole.

practices have been known, under the influence of strong faith, to produce the most salutary effects. Among the ancients, although we find Hippocrates, Galen, and Aretæus, deriding superstitious and fantastical remedies, Alexander Trallianus, an author in other respects of sound judgment, professes his belief in some of the most extraordinary specifics, such as the liver of a weasel freed from bile taken for three successive days fasting; the skull of an ass; the ashes of clothes stained with the blood of gladiators; and other remedies equally ridiculous. And though Pliny affects to reprobate such remedies, we detect him recommending the testicles of bears, and stones taken from the craws of young swallows, in epilepsy. Neither can we entirely acquit Celsus himself of aberration from reason, when we find him recommending for epilepsy the warm blood of slain gladiators. But from what has been said at page 183 and 207, of some moderns, such as Bacon and Boyle, we ought not to be too severe in censuring the less enlightened ancients.

It is a curious question how these numerous irrational practices, not founded on the interposition of supernatural agents, are to be accounted for. May it not be, that among rude nations, when it is perceived that in every interesting event there are a number of concomitant circumstances, among which it being impossible for ignorant men

to discriminate those which are the real physical agents, from those which are either casually present or inseparably connected as collateral effects, they as readily ascribe the agency to some of the latter as to the real efficient cause, continue to do so, and transmit their false and perverted notions to their children and their children's children? *

It has been already mentioned, that the remedy specifically appropriated for these maladies of the mind, is the cultivation of natural knowledge; and it is equally curious and gratifying to observe, that though the lights of science are attained by only a small proportion of the community, the benefits of it diffuse themselves universally; for the belief in ghosts, and witches, and judicial astrology, hardly exists, in these days, even amongst the lowest vulgar. This effect of knowledge, in banishing the vain fears of superstition, is finely alluded to in the last words of the admirable lines already quoted from Virgil, *strepitumque Acherontis avari.*

The inference, from the whole of these reasonings is, that the entire phenomena of animated, as well as inanimate existence, are referable to the

* See some very pertinent remarks on this subject in the Philosophical Works of Mr. Professor Dugald Stewart.

established order of nature, and are so many exemplifications of her laws: and that the truths derivable from the knowledge of them, are the only sure guides of human conduct in medicine, as well as in every other department of practical life.

SECTION V.

THIRD SOURCE OF ERROR.

DIVERSITY OF CONSTITUTION.

Comparison of Physical and Mathematical Truth —Diversity of Constitution not synonymous with Idiosyncrasy; but comprehends the Consideration of Temperaments, Predispositions Diathesis, and Individual diversities—Illustrations drawn from Small-pox — Opium and Scrofula — The danger of resting general Rules of Practice on single Cases illustrated by the Practice in Fever. —Some Remarks on Purgatives—Their abuse —Their Elective operation.

The third head of causes, which retard and obstruct the progress of medical knowledge, is the Diversity of Constitutions.

Practical knowledge in medicine, as in every other art, proceeds on the assumption, that the course of nature is steady, and that what has a given effect on one human subject, will have the like effect upon another. From what has already been said, however, it is manifest, that this holds

less strictly in the living human body, than in any other subject in nature to which art can be applied. The simplicity of the laws of inanimate nature, admits of the most certain inferences, whereas the indefinite action and re-action of the numerous faculties peculiar to life, enumerated in the first section, add greatly to the difficulty and uncertainty of experiment and observation, as already set forth. But this is not all; for constitutions being endowed with various degrees of each of these faculties, an endless variety is found to take place among individuals, giving rise to that uncertainty in the results of medicine, which has brought upon it the character of a conjectural art.

It has already been remarked, that the operation of the mind, by which mathematical truth is discovered, is quite different from that inductive process, by which physical and moral truths are ascertained. These departments of science are farther distinguished by the rigid precision of mathematics, as contrasted with the various degrees of probability which characterises physical and moral subjects. The first, like the other, therefore, can never admit either of doubt or conjecture, or as it is better expressed by Dr. Warburton, " Probability, " through its utmost infinite degrees, from simple " doubt to absolute certainty, is the *terra incog-* " *nita* of the geometer; and yet here it is that the " great business of the human mind, the search

"and discovery of all the important truths which "concern us as reasonable beings is carried on; "and here too it is that all its vigor is exerted, for "to proportion the assent to the probability ac-"companying every varying degree of moral evi-"dence, requires the most enlarged and sovereign "exercise of reason." It is owing to this, no doubt, that many able mathematicians have given but small proof of eminent sagacity in other branches of knowledge, and have been the frequent dupes of credulity in matters of physical and moral truth, whether in science, religion, or in the practical affairs of life. Let it not be understood, that the author means here to undervalue or disparage the exact sciences; on the contrary, no one can entertain a more unfeigned admiration of attainments requiring the most exalted and rare powers of the human mind, and of which the sublime discoveries are indispensable to many of the most useful arts of life. Thus do the artificial habits and rational nature of man render him not only the subject of all others the most difficult of investigation, as has been already observed, but of all subjects, whether in the physical or moral world, the most difficult to manage and to treat.

What is here meant by diversities of constitution, is not exactly synonymous with what is technically termed *Idiosyncracy*, by which is understood some rare peculiarities or exceptions in the consti-

tutions or habitudes of individuals. The diversity here stated answers more nearly to what is called *Temperament*, when applied to the original constitution, such as the scrofulous, the lax, or the tense, or to what are called *Predispositions*, or *Diatheses*, as applied to acquired habits, such as gout or scurvy. And I mean to include under this title what is still more comprehensive than all these, namely, that diversity which takes place more or less in every individual as compared to every other, no two constitutions being precisely alike, any more than the features of the face.

I never could satisfy myself regarding the doctrine of Temperaments, as stated either by the ancients or moderns. I never could perceive in their distinctions either precision, utility, or truth. Nor is this to be wondered at, when it is considered that the terms *Sanguineous*, *Melancholick*, and *Phlegmatick*, are founded on certain fanciful theories already alluded to, to which I can annex no definite meaning, nor any practical application. The only characteristick distinctions which I can recognize as authorized by nature are the following. 1st. The *Tense*, otherwise designated by the terms *Crispum* and *Strictum*, as opposed to the *Flaccidum* or *Spongiosum*. 2. The *Scrofulous*, as opposed to the *Non-Scrofulous*. 3. Those subjects in whom there is a prevalent excess or

defect of *Muscular Mobility*. 4. Those in whom there is a prevailing excess or defect of NERVOUS *Sensibility*. With regard to the other diversities, they are so numerous and indefinite, that practically considered, I can see no room for distinguishing them into classes, but would rest satisfied with marking such differences as are discoverable by observation made on such individuals as may fall under our observation and treatment.

I shall now endeavour to illustrate this part of the subject by some familiar examples.

What can be more expressive of Diversity of Constitution than the phenomena of small-pox. In some, the disorder is so slight, as not to interrupt the business of life, even when not communicated by inoculation; while in others, it is as malignant and mortal as the pestilence: and there are all the intermediate shades, diversified to infinity by the number of pustules, the degree and kind of febrile action. There is a like diversity, in some measure, in all diseases. The different degrees of susceptibility to small-pox, and other morbid poisons, may also be adduced as a striking exemplification of this diversity of natural constitution; for, of persons equally exposed to casual infections, numbers escape altogether. And were it not for this diversity, in point of fatality and susceptibility, in small-pox, plague, and other

epidemics, the human species might be extirpated by any one of them.

There could hardly be adduced a more striking example of the unaccountable peculiarity of constitution, than the familiar fact of the diversity of individuals with regard to their various susceptibility of sea-sickness. Some are so constituted as never to be at all affected by it; the majority of those who are exposed to its causes become exempted from it by time: but some are so constituted, as never to get the better of it, though ever so long at sea. It would be in vain, I believe, to search for any other cause of this, than that primordial and inscrutable peculiarity in which all the other diversities of the human constitution originate.

The like diversity is observable in the operation of most remedies. What can be more different, and even opposite, for instance, than the operation of opium on different constitutions? It is a medicine of such eminent and beneficial effects in the majority of constitutions, by procuring sleep and assuaging pain, that the art of medicine could hardly be practised without it. Yet there are innumerable individuals so constituted as not to admit of relief from it: some in which it is so far from producing these benignant effects, that it

causes great inconvenience and distress, such as sensorial disorder, sickness at stomach, nervous tremors, febrile heat and anxiety: some in which, though it disagrees in ordinary circumstances, it will procure relief in cases of intense spasmodic pains: some in which it proves ineffectual, or noxious, in every circumstance.* There is more or less diversity, though not so remarkable as here, in the operation of most, if not all medicines, particularly with regard to the dose required to produce the same effect on different subjects.

I shall illustrate this subject by one other example, which I the more willingly do as a very valuable practical indication belongs to it. I have found, in the course of my practice, that subjects belonging to what may be called the Scrofulous Temperament, both bear and require a more generous diet than other persons. And this is important with a view to prevention as well as cure; for scrofula ought to be considered rather as a Temperament than an actual disease, and many strongly affected with it may pass through life without any sensible manifestation of morbid

* Professor Kuhn, of Philadelphia, mentions a species of *rhus* growing in Pennsylvania, the exhalations from which are entirely innocuous to some persons, while they are deadly to others. American Medical and Philosophical Register.

affection. My attention was particularly drawn to this from having remarked, that the only one of a very numerous family of high distinction, who never was affected with strumous disorders, and the only one who escaped phthisis pulmonalis in early life, was also the only one who had been allowed in childhood and youth a free use of wine, strong malt liquor, and animal food. Similar remarks in other scrofulous families so confirmed me in this opinion, that I acted upon it with the most decided success. I found a like confirmation in a fact stated by my ingenious friend, Mr. James Russell, Professor of Surgery in the University of Edinburgh. In a tract on Scrofula, he relates, that in a large scrofulous family of his acquaintance, one half of the children were brought up by meagre diet, and watery beverages, and were all affected with strumous swellings and sores; the other half were nourished on animal food, and such an allowance of fermented liquors as would have injured other children, by producing feverish heat and repletion, and they all escaped these symptoms of disease. And it is curious farther to observe, that when those born with this constitution arrive at the adult state, they bear free living and habits of intemperance without being subject to schirrhous livers, dropsies, and the other disorders brought upon others by habits of ebriety.

It belongs to this part of the subject to remark, that the effect of medicines, and other powers, affecting the human body, are very different in the same individual, at different times and in different circumstances. I have known opium disagree with persons in their early life, and agree with them in more advanced age. This same medicine, also, though highly adverse to some constitutions in ordinary circumstances will, as mentioned above, procure relief under severe spasmodic pains, such as those from gall stones when unaccompanied with inflammation.—An example applicable to the same subject, may be taken from the controversy regarding the safety or danger of sleeping in damp sheets. A very eminent physician* has argued, that the opinion of this being dangerous, or even hurtful, is little better than a vulgar error. Others are equally persuaded of the reverse of this. The truth seems to be, that to those who are in high health, and have a vigorous circulation on the surface of the body, capable of re-action, this practice is harmless;† but in those who from age. infirmity, or natural constitution, have a languid

* Dr. Heberden. See Transactions of the College of Physicians, vol. ii. page 521. London, 1772.

† It may be remarked that, external cold in a given degree, excites heat, not only on the surface, as when the faces of healthy young persons are exposed to a cold wind, but also excites the force of the circulation when internally applied, as ascertained by Sir Everard Home. Phil. Trans. vol. 104, p. 585.

circulation in the cutaneous vessels and in the extremities, the flow of blood to parts so remote from the heart, is checked by the cold, and dangerous determinations are made on internal parts.

It may be fairly questioned, whether diversity of constitution has had its due weight in the contemplation of medical observers. It is evident, that unless we are fully aware of it, we may expose ourselves to the same fallacy as those who in the fable, made the contradictory report with regard to the colour of the chameleon. This consideration strongly points out the necessity of accurate induction, extensive observation, and the comparison of facts. In a limited observation, to which only one or more cases of the most infrequent effects of a medicine may have occurred, there is a hazard of erecting an exception into a rule, by mistaking these facts for instances of the universal or general effects of it. This is a very usual source of error, for exceptions being rare, are more striking, and taking a more ready hold on the memory, produce a proportionate influence on practice. But it should constantly be born in mind, that it is only by a sort of arithmetical computation, founded upon large averages, that truth can be ascertained; and hence the danger of founding a general practice on the experience of a single case, or a few cases. This danger of being misled by exceptions, is also greatly encreased by the publication of single ex-

traordinary cases, which too much abound in the numerous periodical journals of this country, tending more particularly to puzzle and distract young practitioners. This seems to be the chief cause which has retarded the progress of vaccination in England above any other country. The peculiar exuberance of our press brings into notice a few adverse cases, which produce an undue influence on weak minds, not aware that for every such case, there are many thousands of favourable cases which are never heard of.

Does not the diversity of constitution also account, in part, for the proverbial discrepancy imputed to medical opinions, and the deplorable controversies which have too often existed among practitioners and writers? Were the members of the profession fully aware of this cause of difference, would it not lead them into an amicable endeavour to reconcile and account for the contradictory reports of their respective modes of practice, instead of engaging in contentious argumentation, not always carried on with that dignified coolness and candour, which becomes a liberal profession?

There is nothing in which a young practitioner should be more on his guard, than being misled by the sweeping dogmas of schools, and the indiscriminate practices of sects, or of favourite practitioners. This evil may be conceived to grow

up in the mind of a tyro, in the following manner. Let him at his outsetting, either at a school of physick, or in witnessing the practice of some private practitioner, meet with one or two impressive and imposing cases, terminating happily under a particular treatment; this will attach him undeviatingly to the like kind of practice for the remainder of his life, unless his mind should be duly prepared by the caution here inculcated. In a typhous fever, for instance, it may be the lot of one practitioner, while serving his noviciate, to have witnessed, either under his own care, or that of some respected instructor, one or two striking cures, from an exhibition of strong cordials: another has witnessed life saved, as he believed, by well timed and free evacuation from the bowels: to a third, it has occurred to see beneficial effects from general or local blood-letting: to a fourth, it has occurred to see one or two cases which being left in a great measure to themselves, have, by the salutary efforts of kind nature, been conducted to a safe termination. Now, each of these having from his limited opportunities of observation, imbibed a persuasion, that his own method is universally applicable, is guided by it as the rule of his future practice. Nothing seems more clear to a comprehensive mind, than that they are all four right, in so far as relates to their respective class of cases; and that they are all wrong in regard to the general principles of practice. The cordial method of the first, is well

calculated for those constitutions, in which the principles of life are on a reduced scale, either by original constitution, or by being brought to a low ebb by previous exhaustion, or the depressing agency of morbid poisons; and in some such cases, the cordial practice in its utmost extent is required to save life.—The second style of practice, is well calculated for those cases, in which there is a redundant and vitiated secretion of bile, or other humours, in the *viscera* of the abdomen. It is incredible with what rapidity and abundance vitiated feculent matter will in some cases be generated and accumulated: insomuch, that one of the main points of practice will consist in a vigilant attention to the state of the bowels, and the administration of proper purgatives. Such cases occur most frequently in tropical climates, and in the autumns of temperate climates. On the other hand, though in most cases the alvine secretions are vitiated in various degrees, yet I have met with continued fevers, in which there was no departure from nature in the quality of the alvine discharges. In the third case, general or local bleeding is not unfrequently indicated, by the state of the pulse, or by the heat, pain, tension, or tenderness to the touch, evincing sanguineous determination on vital parts, that is, the brain, lungs, or abdomen, whether from locally encreased arterial action, or from simple congestion, in consequence of a preternatural laxity of the vessels in particular

organs. This admonition is particularly applicable to the state of the brain, in the affection of which, the chief danger in continued fever consists. There is by nature in health a strong circulation, and a more powerful generation of heat in that organ, than perhaps any other. In fever, therefore, these should be abated, not only by general and local bleeding, but by the application of cold water when delirium is prevalent. The last method, that is the negative, or what has been styled the *Expectant*, is well adapted to those cases which have none of the forementioned tendencies, and to which the self-healing powers of nature are all-sufficient. There are many cases, in which a mixture of these methods is adviseable: and in most cases the practice requires to be varied in different stages of the fever. These remarks will apply also to puerperal fever and scarlet fever; and it is fondly to be hoped, that when it is duly attended to, no one method of practice can be generally and indiscriminately applicable, an end will be put to those deplorable controversies, carried on in some instances with much acrimony and illiberality, to the great discredit of the profession and detriment of the sick. When practitioners become fully aware of these varieties, it appears that no more than an ordinary degree of discrimination and sagacity are requisite to regulate the treatment conformably to them. It may be here stated, as a general remark regarding the

treatment of fever, that in the usual practice of our time, there seems to have been rather too great a timidity with regard to bleeding, whether general or local. But on the other hand, the opposite practice has of late been brought into discredit by its excessive and indiscriminate abuse. Between the two, future practitioners, with the advantage of the errors of both, are likely to act more rationally and successfully.

In a work of Dr. Hamilton's on the utility of purgative medicines, these remedies are recommended not only in typhous fever, but in scarlet fever; and he does not qualify this advice by stating that there are any cases to be excepted. I have certainly seen cases of both these sorts of fever, without any perceptible deviation from the healthy state in the secretions of the abdomen, and in which purging would seem not to be called for, particularly in scarlet fever, in which the employment of purgatives, as a general practice, is considered by the best practitioners in this quarter, as highly pernicious;* and there are few incidents more certainly fatal in this disease, as the

* In the later editions of his work, Dr. Hamilton has qualified his expressions, by saying that he did not mean to recommend positive purging in typhous fever, but only that great attention should be paid to the bowels, so as to keep up a free state of them; and with regard to scarlet fever, he wishes

exhaustion brought on by a spontaneous diarrhœa. Though it is to be wished that the author of this instructive work had expressed himself in a more qualified manner, he has by no means merited the severe chastisement inflicted by a German Journal, where it is said, that "Hamil-"ton's recommendation of purgatives in typhous "fever, only proves what blunders and absurd "methods of treatment the human body can, "in certain circumstances, withstand."* Whatever error our author may have committed, these journalists have been guilty of a still greater, by denying the utility of the practice in all cases whatever. And I beg to repeat that great benefit has been derived from Dr. Hamilton's work; for I remember the time when much less attention was paid to the quantity and quality of the alvine discharges, as indications of the diseased state of the bowels, than has been the practice since its appearance. And I was the more disposed to approve of this work, that it had previously occarred to me both in the West Indies and in England, to witness the pernicious effects of neglecting purging, and that I had occasionally reason to believe, on inspection after death, that the

to be understood to mean that he does not approve of full purging, except in the commencement of the disease, when there is great heat and repletion.

* See Bibliotek der Heilkund I. Band, p. 184, Berlin, 1809.

fatal event was, in part at least, imputable to the unsuspected congestion of *feces*.

As the present subject of discussion regards the distinctive application of medicine, I shall take the liberty of making one or two more remarks on this work, which I should not stop to do, if I did not entertain a high respect for its author.

One of the diseases, in which he recommends, unqualifiedly, the employment of this treatment, is the *chorea sancti Viti*. The qualified adoption of this practice, I am so far from disputing, that I lately imitated it with success in the case of a young female from the East Indies, in which the vitiated quality, incredible quantity, and long continued discharge of alvine *sordes*, was such as to bid defiance to all the principles of physiology and pathology, to account for them. But in a young English female, under my care, about the same time, for the same complaint, nothing preternatural being observed in the alvine discharges after the first clearance of the intestines, she was successfully treated by the cold bath and metallic tonics, chiefly the sulphate and oxyde of zinc, and the recovery was effected in a shorter time than in the other case. I found that, in St. Thomas's Hospital, the like success attended the latter treatment of this disease. Opium, hyosciamus, and leeches to the temples, were found good auxiliaries.

There is another point, in which I feel myself bound to declare my dissent from this respectable practitioner. He denies that different species of purgative medicines possess distinct powers over the different species of matter to be evacuated; and contemns the notion of cholagogues, hydragogues, &c. In the course of my experience, there is no practical fact with the truth of which I have been more satisfied, than the specific, or what has been called the elective action of the various species of these remedies in stimulating different organs, in dislodging and eliminating different species of corrupted secretions, and other recrementitious matter. What, for instance, can be more different than the operation of aloes acting as a mere eccoprotick on the muscular fibres of the intestines, and only in a particular portion of them, namely, the descending colon and rectum, and expelling only solid fæces, from that of elaterium, of which half a grain, taken three or four times at the interval of half an hour, evacuates immense quantities of serous fluid, exhibiting an example of the wonderful power of sympathy. For, what happens here, is that an impression made on the internal surface of the stomach, by a few particles of matter, conveys without its actual presence, and by magick, as it were, an impulse to the most remote extremities, rousing their absorbents to action; and, in case of *œdema* there, awakening the sleeping energies of

these vessels, which, like millions of pumps at work, transmit the morbid fluid to the intestines and urinary passages, effecting a detumescence of the hydrophic limbs in the course of a few hours, and affording a striking illustration of the sympathetic action of medicines, and an instructive example of the operation of those of the sorbefacient class. Again, what can be more different than the operation of neutral salts and calomel, the former exerting but little influence beyond the surface of the intestines, exciting the action only of the serous exhalants, and mucous follicles; while the other, by extending its stimulus to the biliary ducts and pores, detaches foul congestions, which the other could not reach. And I have seen a dose of calomel, given after a full dose of salts, bring away large quantities of dark-coloured slimy fæces, from various glands, ducts, biliary pores, and gall bladder, which had remained unmolested by the former medicines. The *scybala* also so frequently lodging in the cells of the colon, and the unsuspected cause of febrile irritation, as well as intestinal indisposition, will elude the operation of saline purges, but yield to calomel combined with jalap, and more certainly if followed up by a dose of senna and salts, or castor oil. There is a familiar epithet given to this class of remedies, which though hardly in use, except among extra professional persons, is extremely expressive and apposite; they call this species of

purgative *searching physick.* Ipecacuanha acts specifically on the stomach, and other medicines on other portions of the intestines and on different glands; and, it is presumable, that no two articles stimulate equally the same organ. It is for this reason, that compound purges are found more beneficial than simple articles, as they touch a greater number of the intestinal excretories.* The combination found most convenient and efficient, and most employed as a general purgative in the practice of this metropolis, when no specific operation is indicated, is a mixture of purging salts and senna, a combination, but little employed by Dr. Hamilton. Dr. Cullen used to say that senna was one of the best purgatives, if it could be divested of its griping quality, which he had in vain attempted by manna, and various aromaticks. It has been found, that the combining of it with salts completely answers this purpose in most constitutions.

* See an article, by Dr. G. Fordyce, in the second Volume of Transactions of a Society for the Improvement of Medical and Surgical Knowledge, p. 214, London, 1800.—Without reference to this, or any other mode of reaasoning, Sydenham (see his Treatise on the Gout) and other practitioners have recommended empirically a mixture of medicines of similar virtues. One of these practitioners being asked by his patient why he put so many ingredients into his prescription, is said to have answered more facetiously than philosophically, but quite in conformity to rational practice, "in order that the disease may take which it likes best."

After the exposition which has been made of the great variety of constitutions, would it be too much to affirm, that all the practical works in existence ought to be re-composed, in order to insert in them, for the benefit of mankind, and the credit of the profession of physick, the following qualifying words? "The practice here recommen-
"ded will be found to answer in a very great ma-
"jority of cases; but in imitating it, there are
"numerous exceptions to it, which it behoves every
"judicious and conscientious practitioner to bear
"in mind." There is a sentiment similar to this, in Dr. Anderson's Agricultural Tracts. He says,
"the inutility of publications on agriculture, has
"chiefly been owing to the authors not specifying
"clearly the nature of the soil to which the prac-
"tice recommended applies."

SECTION VI.

FOURTH SOURCE OF ERROR.

THE DIFFICULTY OF APPRECIATING THE EFFORTS OF NATURE, AND DISCRIMINATING THEM FROM THE OPERATIONS OF ART.

The great advantage of ascertaining the limits of the Natural and Artificial Means of Restoration.—A Scale of the Curability of Diseases.—Rude ages, and the Ignorant of all ages more confident in the powers of Art, than enlightened ages.—The great advantages, both Medical and Juridical, of becoming acquainted with the true History of Diseases.

THE next obstacle, in the way of our practical judgments, is the difficulty of ascertaining to what degree the efforts of nature operate in the restoration of health, in what cases, and to what point the interposition of art is necessary and salutary, and how the operations of nature and of art are to be distinguished from each other.

The self-healing powers of nature have already been adverted to, in enumerating the principles

peculiar to life. This is one of the most important and fundamental characters of life, being that which is termed at the beginning of this work, the Restorative Principle. That there is such an energy implanted in animal nature, must be obvious to the most illiterate and careless observer; for both, in mere animals and in man, not only wounds recover, but various maladies are removed, without any interposition of art. This is effected by virtue of the energies which sustain life, from the beginning to the end of its existence, in opposition to the noxious and destructive causes with which it is incessantly assailed, and perpetually at war, as it were. Such, indeed, is the virtue of this self-preserving and presiding energy, that whatever deserves the name of *cure*, is referable to it as the work of nature; for the operations of art consist merely in regulating it, either by exciting it when languid, restraining it when vehement, in changing morbid action, or in obviating pain, or irritation, when they oppose its salutary courses. This, I apprehend, is so well understood among well educated physicians, that the word *cure*, as applied to their own merits, is proscribed as presumptuous, and rarely, I believe, escapes the lips of any practitioner, whose mind is duly tinctured with that ingenuous modesty which characterizes the liberal and correct members of the profession.

It has already been fully argued, in the beginning of this Dissertation, that notwithstanding this *vis medicatrix naturæ*, the interposition of art, in the human species at least, is founded in reason, and necessary for the preservation and restoration of health; and it would be highly desirable, if the provinces of nature and art, could be defined by some precise line of demarcation, in order to prevent mutual encroachments; and so to instruct the practitioner, that he shall neither be too sanguine and officious, nor too supine, inert, and despondent. Cases occur in which the perfection of skill consists in abstaining from all active remedies, either because the restorative powers of nanature are adequate, or because the disorder is too powerful and untractable to be subdued, as in the irremediable alteration of structure in vital organs. Youth and inexperience can seldom be brought to see cases in this light, and are, therefore, apt to institute an active and prejudicial treatment, thereby adding to the sufferings, and perhaps the danger, of the sick, by the administration of revolting and hurtful remedies, and where greater age and proficiency are satisfied either with looking on and consoling, or confining themselves to an innocuous negative, or palliative practice, so as to secure the practitioner from the suspicion of neglect, and to avoid throwing the patient into despair, by abstaining from all attempts at cure, or even relief. But though the

young and sanguine ought to have deeply impressed on their minds the following maxims, *Saltem non nocere*, and *peccata omissiones leviora sunt peccatis commissionis*, it is nevertheless true that many have fallen victims to the scepticism of practitioners. As the whole doctrine of prognostick, so important to the interest of the sick, and the character of the physician, depends on a nice exercise of judgment in discriminating the degrees of the curability and danger of diseases, it would be of the utmost importance to establish some rules regarding this.

No precise definition nor graduated scale of diseases expressive of the degree in which they are curable, has been attempted in so far as I know; and it must be confessed, that on a subject so vague, little more can be effected than by that approximation which good sense and judgment will suggest, as applicable to individual cases. The Author submits the following outline as the basis of a more extended rule on this subject. It is founded on a classification of diseases, as they affect the three great vital cavities of the body. Those of the head, such as epilepsy, mania, hemiphlegia, and hydrocephalus, seem to be the least under the control of art, owing probably to the very delicate texture of the

brain: those of the abdomen on the other hand, such as inflammation of the bowels, bloody flux, and cholera, afford us proud triumphs of medical efficiency; for it will be conceded by the most sceptical, that without the intervention of art, a great majority of such cases would prove fatal: those of the thorax, intermediate to the other two in situation, are also intermediate as to the degree in which they are medicable, the chief of them being inflammation of the lungs, asthma, and consumption, the two first affording the most unambiguous proofs of life being frequently saved by a vigorous interposition of medical agents, while the last bids defiance to all the resources of art.*

One of the principal steps to be taken for ascertaining the efficacy of remedies, as distinguished from the restorative efforts of nature, will consist

* By consumption, is here understood that disease in which the parenchymatous structure of the lungs is irremediably injured, the proximate cause being abscesses consequent on tubercles. There are cases of a curable nature, which, from a similarity of symptoms, are not unfrequently mistaken for the true phthisis pulmonaris, and of which the proximate cause is a chronic affection of the mucous membrane lining the tracheal and bronchial surfaces. It was first discovered by Mr. John Hunter, that internal surfaces, whether mucous or serous, could, when in a state of inflammation, secrete true *pus*, without any breach of structure, or being in the state of a sore. The existence of pus, therefore, cannot, as was formerly believed, be a test of the existence of abscess.

in obtaining an accurate history of diseases, particularly in circumstances in which little or no artificial means have been employed. Without some such standard of comparison, the utmost ambiguity, with regard to the effects attributable to medicine, must prevail: and there is perhaps no subject more exposed than this, to that most common of all fallacies in the general practice of life, as well as medicine, the mistaking the *post hoc* for the *propter hoc.* Some of the early records of physick are very valuable in this respect. Hippocrates, for instance, in his epidemics, gives a number of minutely detailed cases of fever, in which little or no medicine was employed, few having been then discovered. The results are in support of the argument of those who maintain the opinion in favour of artificial means; for the proportion of mortality being that of twenty-two on forty-five, far exceeds that of any modern statement, in the like cases.* In the present times, so many remedies are known, that the omitting of them, with a view to ascertain the comparative powers of nature and art, would be deemed an unwarrantable experiment; so that an inquisitive mind, prone neither to scepticism nor credulity, but anxiously and honestly intent on observation, finds it nearly impossible to

* See Medico-Chirurgical Transactions, vol. iv. page 128, where this subject is treated more in detail, in an article on the proportional prevalence of mortality of diseases, by Sir G. Blane.

institute satisfactory inductions for the regulation of practice.

The accurate history of the natural course and character of diseases here recommended, is also of the highest utility, by enabling professional men to distinguish the true and natural causes of death and disease, from artificial, false, or imaginary causes, particularly the cases of poison and alleged sorcery. How many victims would have been saved from the infliction of torture, and the most cruel deaths, which rend the heart while we read of them, had there been professional persons sufficiently enlightened to have convinced judges of the mistake they were inadvertently falling into by convicting unoffending beings, accused either falsely, or of imaginary crimes.

In rude ages, and even in those ages in which science has been in some degree cultivated, there are examples of artificial means being carried to a most pernicious length. And it is remarkable, that in this stage of knowledge, artificial means were more confidently and actively resorted to, than in the most advanced period of improvement. In wounds, for instance, the spontaneous cure of them was not understood nor adverted to, till the times in which both learning and experience had attained their present degree of perfection. It was

in the days of ignorance, in which the officious and pernicious interference of art was carried to the most extravagant length. It is related by Ambrose Paré, the father of French Surgery, who lived in the middle and end of the 16th century, that it was the custom to apply boiling oil to recent wounds, and to perform amputations with red hot knives. Being surgeon to the army, he observed, on one occasion after a battle, that from the impossibility of overtaking all the cases by regular dressing, some were apparently neglected, no hot oil being applied; but having remarked that these cases were next day in an incomparably better state than the others, his eyes were opened to the absurdity and barbarity of the old practice. This induced him to suspect the like errors in other points; and he was the first in France who promulgated rational methods of treating surgical cases. Analogous to these is an incident related of the great Father of Surgery in our country. John Hunter, in early life, was employed as a surgeon at the siege of Belleisle, in the year 1761. After an action some French soldiers, who had gun-shot wounds, hid themselves in a barn for four days, at the end of which time their wounds were found in a much better state than those whose wounds had, according to the universal method of treatment at that time, been dilated by the knife. This of course proved a

lesson for future improvement. Many casual instances occurred in the late war, tending to the like inferences. It was found after the battle of Waterloo, and other battles, that many of the wounded officers and men who were left on the field all the succeeding night, or even longer, as at the battle of the Pyrennees, where the ground being woody and full of rocky ravines, the men were not immediately discovered, were found in a much better state than those who had the advantage of warm quarters and alimentary cordials. This was more particularly the case with regard to gun-shot wounds in the thorax. But this observation will not apply to such wounds as consist in severe lacerations, and fractures demanding amputation : for it has been established by most correct evidence, that great benefit in such cases is derived from immediate operation,* and much disadvantage from a deferred one.† The benefit supposed to be

* See Observations by Mr. A. Copland Hutchison.

† This is a point of the highest practical importance, and was first stated in a clear light by Mr. A. Copland Hutchison, in a work published by him in 1816, entitled, "Some Practical Observations in Surgery," and in another work, by the same Author, in the following year, entitled, "Some farther Observations on the proper period for Amputating in Gun-shot wounds." See also an article in the Transactions of the Medical and Chirurgical Society, for 1817, by Dr. Quarrier, Surgeon of His Majesty's ship Leander, in the action off Algiers, in August

derived from the Royal touch in scrofula, has been ascribed by some author to the like cause; for this is a disease in which active practice, particularly the use of the knife, has been proved hurtful; but when, from the confidence in the touch, these practices have been omitted, and nature alone allowed to act, recovery has been effected, not to mention the effect of confident hope in promoting the cure of this and all other disorders.

It would be endless to enumerate all the irrational practices in medicine, from those of the most gross savages, as related by Mr. Hearne in his travels to the Arctic regions, to those of refined ages. The cure of wounds and sickness was there undertaken by jugglers swallowing, or pretending to swallow, knives and swords, and by the friends of the patient howling and fasting for several nights and days. But are the practices of a civilized age and country, such as the sympathetick powder of Sir Kenelm Digby, more rational? They equally allege success in proof of the efficacy of their remedies. This they did under the ignorance of that self-healing power of nature which will effect cures, not only without artificial means, but in spite of them, even though highly pernicious.

1816. The expediency of this practice seems since to have been admitted, in the ample Treatise on Surgery, by Mr. Guthrie, London, 1821.

It is also difficult to mark where nature ends, and art begins; for in the rudest state of society, or in the most destitute circumstances of life in civilized society, though no article of the *Materia Medica* should be administered, there will be an exercise of judgment called for in the application of heat and cold, of fresh or confined air; also of diet and exercise; and by the injudicious regulation of these, nature may be as much thwarted as by a perverted use of remedies. And is not the scope of nature more likely to be mistaken by the ignorant and vulgar, than by persons of cultivated minds? But the warmest advocates for the sufficiency of the ways of nature, ever so wisely interpreted and conducted, will not controvert the evidence in favour of such remedies, as bleeding in pleurisy, or mercury in the venereal disease, and of certain remedies, whether depletory or cordial, in various circumstances of continued fever.

It is manifest, therefore, that a large share of medical skill and judgment must, at all times, and in all cases, consist in ascertaining to what extent nature may safely and advantageously be entrusted with the cure of disease, so as to supersede the unseasonable and injurious interposition of art, and in discerning, as far as possible, what is due to the self-healing power of nature, and what to the co-operating resources of skill, which the practitioner is called upon to exert for the preservation of life,

and the restoration of health. Without some principle, more or less definite on this subject, he would be continually groping in the dark, and would feel himself full of discouraging hesitations and painful reflections. These would take their color from the prevailing character of his disposition. In case his mind had a bias to scepticism, he might on some occasions be unable to satisfy himself, in case of a fortunate result, whether his patient had recovered by *virtue* of the means employed, or in *spite* of them; and in case of a fatal result, his feelings would be still more distressing; for what could be more painful to a conscientious and sensitive mind, than the uncertainty whether the loss of the patient was most imputable to the remedy or to the disease: if, on the other hand, he should be of a character prone to *credulity*, he might be so far blinded as, *bona fide*, to plume himself, and to congratulate his patient on a *great cure*, in what may have only been a *great escape*.

It only remains under this head, to exhort those who embark in the practice of medicine, not to be dismayed by the difficulty of connecting cause and effect, owing to the varieties occurring in the actual operations of nature, and we ought not to give way to a desponding and indolent scepticism, because we cannot always arrive at deductions, possessing mathematical precision.

SECTION VII.

FIFTH SOURCE OF MEDICAL ERROR. THE AMBIGUITY OF LANGUAGE.

Danger of being guided by the Name instead of the Nature of a Disease, exemplified in Sea Scurvy, the Yellow Fever, and Dropsy.

As the end of language is the communication of thought, it is self-evident that there can be no such thing as correct reasoning, unless the same import be annexed to the same words, in the oral and written intercourse of mankind. A large proportion of all the false reasoning and controversy, which has existed among the learned and unlearned of all ages, has arisen from the want of a precise definition of words. The most valuable parts of the writings of Locke, are those which relate to the abuse of language. It is a subject upon which there is great room here to dilate; for none of the departments of practical knowledge have suffered more than medicine, from verbal disputations, engendered by ambiguous words and phrases. It falls under this head, therefore, to caution practitioners, particularly our younger brethren, against

prescribing for the *name*, instead of prescribing for the *nature* of a disease; and it is proposed to illustrate this by a few examples, referring the reader to the chapters of Locke's Essay on the Understanding, which relate to this subject.

The term *scurvy*, in the English language, and *scorbutus* in the general medical language of Europe, has been employed to denote, both cutaneous eruptions, and that disease which is caused most commonly by a long use of salt provisions, and principally known by its appearance in ships which have been long at sea. By having this name in common, these two diseases, though widely different, nay, without any thing in common in their characters, have been considered identical, and treated as such, particularly by a Dutch physician and author, named Eugalenus, in which he was followed by his countryman Boerhaave, and other authors, both British and continental. The consequence of this strange jumble was the adoption of a very vague, inefficient, and inconsistent practice, a practice also in the highest degree pernicious; for it seems to have been mainly owing to the want of a clear conception of the *diagnosis*, and of the peculiar nature of the scurvy, that a simple, infallible, and readily procurable remedy for it, was long neglected, to the incalculable detriment of humanity, and the publick service.

Lemon and lime juice was well ascertained to be a certain preventive and cure of this dreadful malady very early in the 17th century; but the attention of Physicians having been absorbed in vain speculations, and their judgments perverted by the ambiguous import of the word, this excellent remedy was so much overlooked and neglected, that it was not rendered available to the best interests of mankind till after the middle of the 18th century. Had the expedition fitted out under Commodore Anson, in the year 1740, been provided with a few casks of lemon juice, none of those dreadful sufferings which make humanity shudder in perusing the narrative of that voyage, could have occurred. On account of the same most unfortunate misapplication of a word, Boerhaave recommended the use of Mercury in the sea-scurvy, because it is found to be a remedy in various cutaneous affections; and in conformity to this, it is related by Dr. Kramer, that some of the medical officers of the Imperial armies in Hungary, did, in the year 1720, subject to a mercurial course 400 men ill of the sea-scurvy, every one of whom died. Let no one therefore allege that the incorrect application of a single word is of small importance.

Another example, equally illustrative of the fatal effects of the ambiguity and misapplication

of words, may be quoted from the vague acceptation of the term Yellow Fever, which has had a considerable share in creating a controversy regarding the contagious nature of this epidemick; and it is here selected as an illustrative example, both on account of the great importance of the question, and with a view to expose other species of false reasoning in the arguments of those who deny the reality of this contagion. The importance of it will at once appear, when it is considered that on a moderate computation, half a million of lives were lost by it in the space of less than thirty years, in the West Indies, North America, and Europe, after it broke out with such malignity in the year 1793. And it is believed, by those who contend for its contagious nature, that a great proportion of these might have been saved, had those precautions been put in practice which this view of it would have naturally suggested.

This malady had its origin in the great Archipelago of the Great and Little Antilles, and the adjacent continent, and has prevailed there with circumstances of greater calamity and frequency than in any other districts. Pestilential fevers have been known in other parts of the Torrid Zone, as in India, Africa, and above all, in Batavia, but without the distinctive character of the Yellow Fever. These characters, which consist chiefly in a bright or deep yellow color of the skin, and the

vomiting of a dark-coloured fluid towards its termination, are so peculiar that they canot possibly be mistaken.

The ambiguity to which the author mainly alludes, consists in not discriminating that particular species or variety of the disease which at all times prevails more or less in an endemick, or sporadick, and non-contagious form, from that which breaks out at intervals, and spreads in a pestilential and contagious form. The description of the latter is the same with that of the former, except that the bright orange colour degenerates towards the end of the disease into a deep dirty yellow, or rather brown. It is also more violent and mortal, and those who have had it once are seldom susceptible of a second attack.

It is uncertain how long it has existed and prevailed in either form, for the Medical records of the West Indies are too scanty and inaccurate in the 15th and 16th century, to enable us to judge whether the great sicknesses mentioned, were of this kind, or the common malignant fevers of other tropical regions. I have not been able to meet with any precise description of it till the 17th century, and it had not previously to this spread either to North America, or to Europe. It seems probable that no contagious disease is coeval with the existence of the human species, but

that all such diseases have in different ages been engendered by some singular concurrence of circumstances. The sweating sickness can be clearly traced, both as to its origin and extinction. The yellow fever probably first appeared in the 17th century.

But without losing ourselves in conjecture, our observations shall be confined to a brief sketch of its history in the 17th, 18th, and 19th centuries.

The first authentick account we have of it in a pestilential form, and which we chiefly owe to Mr. Lygon, is that which occurred at Barbadoes, in the year 1647, and which was said to have been imported by a ship which arrived there in disastrous circumstances. It is stated to have been a disease in point of malignity, unlike anything that had ever been known there before, and that the mortality was so great, that there were not survivors enough to bury the dead. It shewed itself in the same island in the same form in the year 1695; but the former attack had been so far forgotten, that this was designated the *New Distemper*. As our bounds will not admit of a complete enumeration, I shall pass over some of them, and next mention that which broke out at Grenada in the in the month of March,* 1793, on the arrival of a

* It is material to mark, that this happened in the month of March, which, in ordinary times, is the most healthy season,

ship from Africa, under circumstances of great calamity, and extended itself *progressively* to the whole Carribean Archipelago; from thence in the same year to the sea-port towns of North America, and to Spain in 1800. I here lay a particular stress on the word *progressively*, for this is a most important circumstance in discriminating epidemick from endemick diseases. The latter proceed from the atmospherical miasmata, or exhalations of the soil, and must, in the nature of things, take place *simultaneously*, while it is equally evident, that those which proceed from the morbid effluvia of the body, that is, those which are contagious, must spread progressively.

The first account we have of its appearance in North America, is at Boston, in the year 1692, where it broke out on the arrival of some ships of war, under the command of Admiral Wheeler. This squadron had been engaged in the siege of Martinique, but being foiled in consequence of sickness and other adverse circumstances, sailed with the Yellow Fever on board, for Boston, where no such malady had ever before been known, nor

and the fever seldom or never prevails *endemically*, but in the autumn months called by the French *Hivernage*. It is therefore to be regretted, that so respectable an author as the Chevalier Jonnès should have been so ill informed as to have stated in his valuable work that this fever broke out in Grenada during the *Hivernage*. See Monographie, p. 85.

was it again known there for more than an hundred years, when it was visited by it in common with the other sea-port towns of the American States. I put it to every unprejudiced mind, whether this alone is not sufficient to create a belief in contagion: yet though many more equally well authenticated facts might be adduced, which there is not here space to enumerate, a disbelief of it is still professed by great numbers of the profession?

In the Spanish history, the first authentick account we have of the prevalence of this disease in an epidemick form, is in the work of Don George Juan and Don Antonio D'Ulloa, the mathematicians sent to measure a degree of the equator in Peru, in the year 1735. They say that this yellow fever, which they call *Vomito Prieto*, black or dark coloured vomit, was first known in this form in the Spanish colonies, in the year 1729.

The first account of the Portuguese is contemporary with that of the French. It is related by Ferrayo de Rosa, a Portuguese physician of Olinda in Brazil, that the French ship Oriflamme, and another, on a voyage from Siam to Martinique, in the year 1686,* having put in there, in circumstances of great distress, a pestilential disease broke out, which by his description was the yellow fever.

* See the work of Pere Labat.

And the same ships having proceeded to Martinique, the same disease for the first time broke out there, and that it was new to them, seems implied in their giving it the name of *Maladie de Siam.*

In this sketch we have only now to give the account of its appearance in Europe. In searching records, the first instance I find of it on this side of the Atlantick, is at Lisbon, in the year 1723. The next appearances of it in Europe, are those of 1732-33-44-46-64-1800 at Cadiz, in 1741 and 1803 at Malaga, in 1804 at Gibraltar and Leghorn, in 1821 at Barcelona. Some others might be quoted, but these are enough to shew that there appeared a disease entirely new till then in Europe, perfectly similar to that which prevailed in the West Indies, at the same periods that it attacked only the sea-port towns; and of all these the first, and by far the most frequently, was Cadiz, the only port at which the government of that country permitted ships from their American colonies to frequent: and that it extended to other ports, in proportion to their degrees of vicinity, and intercourse with this one.

I again put it to every candid, unprejudiced, and liberal mind, if it be possible to conceive, whether viewing the subject as a matter of plain common sense, or as a matter of mathematical calculation, that the coincidences of this fever,

as existing contemporaneously in Europe, America, and West Indies, could happen by a mere casual fortuitous concurrence, without any physical influence or connexion of the one with the other?

What the partizans of non-contagion allege, is, that there can be no disease deserving the name of contagious, but what is so in all times, places, and circumstances, and they adduce the small-pox as their prototype. But is it not being guilty of an outrage against common understanding, as well as a violation of one of the best established maxims, both of law and logick, to assume facts and principles, and to reason upon them as if they were proved? Is there any thing either in the absolute nature of things, or in the physical construction of living organic nature, to forbid that a disease may be contagious under one combination of circumstances, and not contagious in another? Is there any point better established in medical history, than that the typhous fever, when in a sporadick form, or when it is treated in spacious, well ventilated and clean apartments with personal cleanliness, is not contagious; but that it is rendered contagious by crowding, closeness, and filth.* I, as well as others, have observed

* I avail myself here of the high authority of Dr. Baillie, and the more so, as what he says on this subject, is contained in a

the like with regard to the erysipelas :* and I have been assured by Mr. Alexander, the most expert and experienced oculist of this country, that when several cases of common inflammation of the eyes are congregated together, they communicate the disease to their attendants.

What therefore forbids the yellow fever from being subject to the same laws as typhous fever, erysipelas, and ophthalmia? According to my own observation, and I might quote that of others, it actually is so. During the four campaigns which I served in the West Indies, it was not my lot to see the yellow fever in its most aggravated state. During that period there were no land expeditions of any consequence on that station, and the devastation of this epidemick has never been great except when originating among large bodies of land troops, especially those recently from Europe.

posthumous work, which by his own directions was to be given only to his particular friends, among whom his executors were pleased to reckon me, and therefore its contents may not be generally known. After remarking that he has not observed in his practice typhous fever to be contagious, he adds, "When "patients are crowded together, and the apartments are ill venti-"lated, I entertain no doubt of this species of fever being capable "of being readily communicated from one individual to another."

* See an article in the third volume of the Transactions of a Society for the Improvement of Medical and Chirurgical Knowledge, by Dr. Wells.

I saw enough however, to convince me of its becoming contagious under particular circumstances; for in the year 1780, a fleet of seventeen ships of the line, having landed a greater number of sick and wounded at the hospital at Barbadoes, than it could properly accommodate, the fever evidently became contagious, of which there needs not a clearer proof than that a young negress, acting as a nurse, caught the fever and died of it; and, as it is observed that blacks, particularly females, are very little susceptible of it, it must have existed in a considerable degree of intensity. As I was in daily attendance at the hospital, this among other cases came under my care.

It is alleged farther, that if the yellow fever were actually contagious, why should it affect Spain and North America in one season of the year only, and why does it not spread among the rural population? This argument is open to the same objection as the last, that of imagining that such questions can be decided by any other rule and test, but those of fact and observation; for there is nothing in the nature of things to forbid a disease from being contagious in one season and not in another, nor from being so in a crowded population and not in a rural situation. And here again we can meet this argument by an appeal to fact, for nothing can be better ascertained than that the contagious character of the plague is

limited by circumstances, being under the control of atmospherical heat. It is historically ascertained, that this epidemick cannot exist either in a high or a low latitude: it has never been known in the torrid zone, nor to approach the Polar circles: the season of its epidemical prevalence in England, has been from June to October: in Lower Egypt it disappears as soon as the canicular heats of midsummer begin: and it is so far from resembling the small-pox in another respect also, that it has never made its way into the New World.

We see from this, that the yellow fever is not singular in having a definite range of atmospherical heat, below which it becomes extinct, for it can only exist while the temperature of the climate is about 80 degrees of Fahrenheit, which it always is in the West Indies. But in temperate climates, it is found that it can exist only in those seasons in which the heat is equal, or nearly so, to that of tropical countries; that is, in the summer and autumn in the south of Europe. This epidemick, therefore, when it prevails in Spain, begins to decline rapidly in November,* and dis-

* I am sorry to be under the necessity of here noticing an inaccuracy, in so respectable an author as the Chevalier De Jonnès. He says, at page 142, that I had asserted that the yellow fever did not prevail in Spain, except in seasons in which the heat was about 80° Fahrenheit, 21° Reaumer, whereas the mortality was as great in November, as any of the preceding

appears before the end of the year. It follows from this, that the northern parts of Europe have nothing to fear from this epidemick; and accordingly it has never made its appearance either in France or England, notwithstanding of their intercourse with the West Indies. The only exception to this is a slight appearance of it at Marseilles in the year 1821.

That the yellow fever should not have spread into the country, is analogous to what is so well

months. In this he has evidently been misled, by not being aware that the returns which he quotes, were the medical returns, which, by the usage of the service, are made up on the 20th of each month; so that the return of November must have included part of October. I perceive, upon inspecting these returns, that the number of deaths by that of October was 226, by that of November 259. But, on inspecting the returns of the Adjutant-General, which are made up so as to include the whole of each month, I perceive that the *whole* deaths of October were 359, those of November 114 It ought also to be considered, that those who are taken ill and die in any one month, may have caught the infection in the preceding month; and M. de Jonnès himself, page 103 of his valuable work, adduces a proof of infection remaining latent between two and three weeks before exciting fever. It ought farther to be considered, that intense and concentrated infection will break through the rules of ordinary cases, as in that of the negress at Barbadoes. The variance of the Medical and Adjutant's returns is therefore greatly in favour of what I advance, inasmuch as it proves the very rapid decline of mortality after the 20th of November. In December the mortality was only 28. In January the disease was extinct. It appears by thermometrical journals, that the heat at Gibraltar rises nearly to 80° in October, and its average in November is 61° to 66°

known of the greater facility with which the plague and other epidemicks, spread in squalid and densely inhabited quarters of a city, than in the open, clean, and airy quarters of it, or in the thinly inhabited districts of the country.

It has still farther been alleged, that so many persons have been known to be exposed to the yellow fever by contact or proximity, without catching it, that it is impossible it can be contagious. It is almost incredible, how those who hazard such an argument, should not perceive that this is the case with all contagions, not excepting their prototype, the small-pox; and it is evident, that if through the goodness of God, there were not numbers who escaped it, or who had it in a mild degree, the human species would long ago have been extinct. And is it not still more extraordinary, that those who argue thus should not clearly perceive that this reasoning militates infinitely more strongly against themselves, for if the yellow fever is caused by atmospheric *miasmata*, and terrestrial exhalations, not a single human being could escape, if all that were exposed to it were susceptible, for every living creature must inhale the ambient air, good or bad; whereas it is quite conceivable that the morbid exhalations or secretions of the human body may be avoided.

The reader must by this time be satisfied, how

utterly vain and inapplicable are the hypotheses of those who, instead of laying their foundation in facts, gratuitously assume principles, or dictate as it were to nature, what she *ought to be*, without stooping to enquire what she actually *is*. And they must be sensible that there can be no sound or legitimate method of solving such questions, but by an appeal to facts. I shall therefore conclude with a bare narrative of a few of these.

The first I shall notice, is what occurred on board of the Hussar frigate, on the occasion of the capture of a French ship off the coast of Carolina, in the month of May, 1795. The French ship was direct from Guadaloupe, where the yellow fever was prevailing. Part of the crew of the prize was taken on board of the Hussar, and in a few days the men belonging to this frigate were seized with the fever. The facts of this case were stated in the Surgeon's journal; but a voluminous writer and zealous partizan of non-contagion, believed, in consequence of enquiries at the publick office in which the documents of this branch of the service are deposited, that he had detected such a gross incorrectness of that journal, as to invalidate its credit. This has been proved to have been founded on a palpable mistake on the part of those who gave this information, and the credit of the journal, and the honour of the surgeon, were completely vindicated, on the evidence of the

heads of that office. The next case, is that of the Palinurus and Carnation. Soon after the renewal of the revolutionary war, in 1803, the yellow fever prevailed at Martinique, both on shore and in the ships, and in none more than the Palinurus, a small ship of war. She was sent to sea to try the effect of a cruise in the Atlantick, and fell in with and took the Carnation, an English sloop of war. What followed I shall relate in the words of the French Author. "Sixty of the prisoners were "taken on board of the Palinurus, among whom "the yellow fever broke out before the eighth day, "and before the twelfth day twelve of them had "died of it, having the black vomit. When they "came to an anchor at Martinique, I being Aide-"de-Camp to General Houditot, was sent on "board to make enquiries. I found that out of "the sixty English, twenty-two had died of the "fever, which they could not have contracted but "from the French crew."* The third fact is taken from an equally credible authority, that of Dr. Caillot, who relates, that a French ship of war from the West Indies, with the yellow fever on board,

* See Monographie de la Fièvre Jaune, par M. Moreau de Jonnès, Chevalier de St. Louis, et de la Legion d'Honneur, Membre Correspondent de l'Academie Royale, et de l'Institut de France. This gentleman is an engineer officer, bearing a high character as a man of science, and though not a medical man, has written an elaborate treatise on the yellow fever, establishing the doctrine of contagion.

having captured a merchant ship from the Mediterranean, off Cape Finisterre, sent some of her own crew on board the prize. The seamen belonging to the prize were taken ill with fever on board of their own ship, and almost all died.* This may be said to be a stronger case than the former, in this respect, that some of the partisans of non-contagion have admitted that a fever may be caught from the foul exhalations of an ill-ventilated ship, but not from the persons of the sick. The last and only other case which I shall adduce, is one in which though the incident did not occur on board of two ships on the ocean, is equally convincing, unimpeachable, and decisive. The documents on which it is founded were furnished to me by direction of the Board of Admiralty, and the circumstances of it are as follows. The Bann sloop of war sailed from Sierra Leone, bound to the Island of St. Thomas, in the end of March, 1823, with a ship's company of 107 white men and officers, and 29 Africans, all in health. A few days after her departure the yellow fever broke out, which made the Captain alter the destination for that of the Island of Ascension, a solitary rock in the middle of the ocean. Before her arrival there on the 25th of April, thirteen white men had died of the fever. None of the Africans were affected. Twenty more died before the 2nd of June. There

* See Traité de la Fièvre Jaune, par L. Caillot, Paris, 1815.

was a small garrison of about thirty-five marines on the Island, all in good health. As the Surgeon of the Bann, and the two medical officers in the Island were non-believers in contagion, no effectual precautions were taken to debar intercourse between the ship's company and the garrison. An hospital was established on shore for the accommodation of the sick of the ship. The consequence of this was, that in about a week the members of the garrison began to be affected, and sixteen men, five women, and four children, perished by it. The description of the fevers by the medical officers left no ambiguity as to the nature of it; and it is needless to say, that these officers soon made the recantation of their opinion regarding its infectious nature, bitterly regretting, that their minds had been corrupted and misled by some superior members of the profession who ought to have known better. This is the only atonement which they and many others have to make for the tragical consequences of their error.

Any one of these facts (to which many more equally cogent might be added,) being sufficient of itself to establish the point in question, an apology is due to the reader for taking up his time with reciting so many, and still more for refuting at so great a length, the fallacious sophistry of their reasonings, on a subject, which being a mere matter of fact, all reasoning is vain and unnecessary.

But as there are many upon whom these reasonings may have made an impression not easily to be effaced, it may not be without its use to have pointed out the shallowness of the arguments, and the hollowness of the ground on which they have reared that pernicious superstructure of sophistry, which has cost their country so many valuable lives, embarrassing and defeating the public service. When we reflect on the horrible scenes at the Island of Ascension, what must be the consequences of exposing whole fleets, armies, garrisons, and populous towns, to the disaster inflicting deadly sufferings on the objects themselves, and heart-rending agonies on their surviving relatives; for calamitous as is the plague, the proportional mortality of the yellow fever is still greater?

It can hardly be believed that there is a single person who, with the knowledge of these facts, still withholds his belief in contagion. It is nevertheless true, that a certain Journalist in America, whose name and place of residence I will, from pity, abstain from exposing, has declared to the world that he is not convinced by them. It is to be hoped he stands alone. If there were others it would be a mere waste of time and words to attempt their conversion, and we can only hold them up as salutary warnings and examples to the junior members of the profession, to be cautious how thny enlist

themselves as partisans in controversies. In looking out for a parallel, we can find none so apt as that of the delirious desperadoes of the Malay nation, who, under the influence of intoxicating drugs run a muck, as they call it, against the lives of their fellow creatures; and are not inveterate prejudice, and the pride of preconceived opinions as subversive of human reason as bang and opium?

Having asserted that the authentick narrative of a single case is sufficient evidence to decide this question, it follows that the many thousand pages that have been devoted to this controversy are superfluous, and that it would be inconsistent in me to add another word. But if it were necessary, well attested facts could be produced to prove that the progress of this epidemick has on innumerable occasions been arrested by vigilant and judicious measures of quarantine, and other means of cutting off intercourse between the infected and the sound.*

* One of the most eloquent and pathetick statements of the horrors of this disease is by Dr. Pariset, who, with two others, was sent by the French government to Barcelona, to examine and make report on it. He says, in a letter to Dr. Robert, a physician at Marseilles, by whose vigilance this disease had been arrested there, dated the 27th of November, 1821, from Montalegre. "A Spanish physician said to us that to deny contagion is to deny God, and he was right. It is in fact to deny the light, to deny evidence as striking as day. We should be culpable to

It is mortifying to reflect how little this epidemick, in common with other pestilential disorders, is under the control of medicine. I suspect that it may be asserted with truth, that no method of treatment has been found so far superior to another as to make any sensible difference in the official reports of the proportional mortality. Purging, bleeding, cold affusion, and the Peruvian bark, have all been employed, and I have no doubt when judiciously and moderately employed, they have all been beneficial; and though some of them have been brought into discredit by having been used in excess, or unseasonably, they have been in many cases the means of palliation, relief, and even cure. It was observed, that the mortality was less in those who were infected on board of the Hussar, and who

leave the field free to error so pernicious, and I cannot conceive a situation more painful than that in which those physicians in Barcelona are placed, who have taken certain persons for their guides and authority. Their own act confounds them, for the cry of so many victims overwhelms them; they are ashamed to live on the graves into which they have precipitated so many unfortunate beings. One moment of sincerity, one slight sacrifice of self-love, a shade of distrust in themselves would have saved Catalonia a load of evils,* and themselves from endless opprobrium and remorse. They hope to escape from opinion, but opinion pursues, overtakes, and judges them, and even the vulgar who exalted them now condemn them."

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* Twenty-two thousand, out of a population of little more than a hundred thousand, died of this epidemick at Barcelona. But this is not equal to the mortality of Gibraltar, in 1804, in which six thousand died out of sixteen thousand, comprising the garrison and town.

had the advantage of medical means, than among those who caught the disease on board of the French prize, who had no medical treatment. I am well convinced that bleeding is pernicious, except at the very beginning of the complaint. The great tendency in the body to run into immediate putrefaction after death, is a proof that the proximate cause must in a great measure consist in the failure of what I have called the Conservative, or Antiseptick principle. The sensorial symptoms did not in general run so high as in other bad fevers. I have seen patients die possessed of their reason to the last hour. The most remarkable appearance on inspection was a gangrenous state of the stomach. This being the case, it is not conceivable that any thing that depresses the vital powers can be adapted to the case. It is also to be regretted, that a great bar is put to the administration of medicine by the irritable state of the stomach. One of the few bad cases which recovered under my own treatment, was that of a captain of the navy, who *apparently* owed his life to a free administration of Peruvian bark in substance by glyster.

But the great and only efficient engine for counteracting this dreadful scourge, consists in the means of prevention ; that is simply, 1st. to hinder as much as possible all congregating of those affected by it, particularly under the aggravating

circumstances of filth, and want of ventilation in barracks, or elsewhere, but most of all in ships, where this disease has most frequently been engendered. 2ndly. When it has declared itself in such places, to enjoin and enforce the most rigid separation, and to prohibit actual contact, association, or intercourse of any kind, between the sick and the sound.

The only other example which shall be adduced illustrative of this subject, is the treatment of Dropsy.

The most common notion that used to be entertained of this disease was, that in all cases, it essentially consists in a debility of the powers of life, which in most instances had been exhausted by intemperate living, paralysing the absorbents, and inducing visceral obstruction. This last consists chiefly in a schirrosity of the liver, produced most probably by the suspension of the absorption and replacement of organic matter, so necessary to this enormous gland, in common with all other parts of the body. The deficiency of the powers of assimilation, a diminished proportion of the red globules and gluten of the blood, a decay of the muscular powers, as also of the restorative principles manifested by the proneness of wounded parts to fall into gangrene, the occurrence too of this disease after profuse hæmorrhages, and from the circulation being mechanically impeded by organick dis-

eases of the heart,* all militate in favour of this opinion. On the other hand, there are cases possessing the pathognomic characters of Dropsy, that is, the accumulation of colourless fluids in the cellular membrane, and in the great vital cavities, attended with scanty urine, in which none of these debilitating causes exist. It will sometimes arise idiopathically, and without visceral affection, as I have seen it do, even in very early life; also after scarlet fever, and after sudden exposure to damp and cold, without any other assignable cause. It has been observed, that, in a large proportion of cases, great quantities of albuminous matter, such as belongs to the serum of the blood, is found in the urine, as is discovered by exposing it to a heat of about 150°, or by mixing with it some nitric or acetous acid. It has also been discovered by Dr. Prout,† that a little fibrine sometimes escapes through the kidnies. It has been farther observed, with regard to practice, that this disease ought by no means to be indiscriminately treated as one of debility, but that bleeding, lowering, and febrifuge medicines, as indicated by an excess of vascular action,

* See Burn on Diseases of the Heart.—Two striking cases of this sort occurred to myself; one, that of a young soldier in St. Thomas's Hospital; the other, that of an old Flag Officer, in private practice. Both were dropsical; and in both, the valves of the heart were found ossified, without any other organic lesion; in neither was there any suspicion of intemperance.

† See his excellent Treatise on Calculous Disorders.

are the remedies to be depended on. And with regard to its proximate cause, which the old writers, and others who regarded it as a disease of debility, were disposed to refer to the defect of absorption, the modern writers alluded to, are more inclined to view it as an active and inflammatory affection, depending rather on excess of effusion than defect of absorption. It cannot be denied that this latter view of the disorder has been too much overlooked by the earlier writers, and that it has been adverted to with greater precision by later authors and practitioners, particularly by Dr. Blackall, in one of the most valuable medical works of these days, and so valuable, that all the well wishers to physick, would be glad to see a like compendious and accurate monograph on every other important disease. In drawing the attention, however, to this class of cases, he seems hardly to have allowed a due weight to that great majority of cases, which unquestionably depend on a deficiency of the vital powers.

The inference intended to be drawn from the whole of this is, that there is a great variety, and even contrast, in cases coming under the generic term dropsy, which require a different, and in some measure, an opposite treatment, and that much exercise of judgment is required, as in the preceding examples, in order to avoid that indiscriminate practice, by which we are led to prescribe for the name, and not the nature of the disease.

SECTION VIII.

SIXTH SOURCE OF ERROR.

THE FALLACY OF TESTIMONY.

No advantage from the Knowledge of others, without Language being clear and mutually intelligible.—More false Facts than false Theories.—Quack Remedies recommended to the world chiefly by their Secrecy.—Origin of Quackery.—Secret Remedies Efficient and Useful—Hurtful by their Indiscriminate Use.—The unbounded Power of Imagination in creating Delusion—Analogous to Dreaming and Mania.—Great Advantage of Descriptive Botany, in perpetuating the Knowledge of Medicines.

Since the life of any individual, however long it may be, and whatever industry and sagacity may have been employed in the course of it, is greatly inadequate to the task of collecting a stock of knowledge sufficient for professional practice: and since he must be indebted to others, whether his cotemporaries and countrymen, or belonging to distant ages and countries, for a large share of

necessary information, it is obvious, that the value of such information must depend on the credit due to the authors, as well as the clearness of the language in which it is couched. Besides the sources of fallacy and error, already enumerated, which apply to the medical practitioner himself, he has to encounter those, which spring from the credulity, ignorance, vanity, self-interest, self-delusion, the love of controversy, the love of singularity and novelty, the want of candour, and the inveterate prejudices of those who report facts. It is a melancholy truth, that there is perhaps no department of human knowlege, in which there is so great a want of correctness, with regard to recorded observations, as well as reasonings, as in Medicine. We ought, therefore, to be strongly fenced against the inroads of error in others, as well as ourselves.*

It was a favourite saying of Dr. Cullen, that there are in physick more false facts, than false theories. It is by the want of due caution with regard to the former, that quackery has chiefly been sustained; for those who do not belong to the profession, being off their guard, from not being in the habit of observing, and reflecting on

* See some acute observations on this subject in a work entitled, "A Reply to the Anti-Vaccinists," by James Moore, Esq. Fellow of the Royal College of Surgeons, London, 1800.

the fallacy of testimony, and other sources of error; and being eager to catch at relief, from whatever quarter, perhaps with minds soured by disappointment, and exquisitely sensitive to hopes and fears however vain, become sanguine and credulous, on the slightet prospect of relief. These impressions are also wonderfully favoured by the operation of mystery and concealment; for, there is a peculiar interest and importance attached to whatever is secret. *Il y a quelque chose de singulièrement piquant, dans le mystère,* says some French author. It is difficult to explain this, but it seems to be an emanation of the same principle in human nature, as the *ignotum pro magnifico* of the poet. The credit of these remedies is also greatly enhanced by the successful cases only being made public; for the innumerable cases in which they are used, whether openly or secretly, without the boasted good effects, still more, if with bad effects, are never reported; while those supposed to be successful, are studiously promulgated. And there is here a farther source of false or dubious testimony; for those who are induced to use these remedies, being anxious to ward off reproach or derision, justify themselves by making the most favourable report, and even by affecting to have received relief: and not unfrequently fancying, and honestly believing that they have actually received it. It is also a curious, and well ascertained fact,

that no *nostrum* has, in any instance, maintained its character, after it was revealed. This was strikingly exemplified in the case of Ward's various remedies, which went entirely out of vogue, the moment they were published, as was done after his death, by an injunction in his last will. And it is still farther in proof of the capriciousness of the world* at large, on medical subjects, that all his remedies are excellent preparations or compositions, and, under the exercise of discretion, well adapted to the diseases which they professed to cure. Indeed, the injury done to the world by secret medicines in general, is not so much from any thing pernicious and inefficient in their nature, as from their indiscriminate use, and the false confidence they inspire to the exclusion of other, and better remedies. On the contrary, it is presumable, that it must have been from some eminent and ascertained good effects observed from them, that the authors of them were first induced to offer them to the publick. No secret medicine has had a more lasting and extensive reputation than James's powder. The

* I perhaps have wronged *the world at large,* and should have confined the remark to England. Professor Nemnich, of Hamburgh, in a narrative of a tour he made in this country, about twenty years ago, calls England the Paradise of Quacks, and enumerates quackery, among the national peculiarities, in the same list with boxing, horse-racing, bull-baiting, and cock-fighting. May not this be imputed to the neglect of Natural Knowledge in English Education, adverted to at page 182.

fair specification of it was never given, so that it has still all the qualities of a *nostrum*, though its main ingredient is known to be antimony. In virtue of this it is a very efficient and useful medicine, and in common with other preparations of that mineral, has an effect on all the secretions and excretions, superior perhaps to any other medicines. As it produces its effect by evacuations, it is particularly well adapted to the beginning of fevers, by discharging superfluous and vitious humours, whether by the primæ viæ, the skin, or the glands, and in so far its reputation is fair and merited. But as a popular medicine, it has passed for an incomparable specific in fevers, without regard to their circumstances, and particularly to the stage of the disease in which it ought to be administered. It is popularly believed to be the great means of saving life in all forms and stages of fever, and the conviction of this is so strong, that it has been not uncommonly administered not only without professional sanction, but in opposition to it. Nothing can be better ascertained however, than that it is a most pernicious drug in the latter stage of fever; and this being the only stage in which life can be said to be in danger, its reputation is thus far founded in error, and this misapplication of it has in innumerable instances produced the most fatal effects.*

* Goldsmith the poet, and Mr. Howard, so celebrated for his benevolence in the regulation of prisons and hospitals, are reckoned among the victims of this practice.

This error is accounted for in the following manner: The first vender of it was regularly bred to physick, and was well acquainted with the usual and most approved manner of treating fever, and therefore well aware of the rough and pernicious effects of full doses of his powder in that state of debility, which is inseparable from the last stage of fever. He therefore treated the disease according to the best established rules with which he was acquainted, but affected to give his powder, and to ascribe the cure to it. But it is believed that he either did not give his powder at all, or in such small doses as could produce no sensible effect. But those who were not aware of this, that is, the whole community at that time, gave the full doses of the powder in these circumstances, with the effect which has been mentioned.——Can it be doubted that if the composition of this medicine were as well known as those of Ward, it would share the same fate?

On the other hand, there are remedies not secret, but entirely inert, which attain a high degree of reputation, most commonly from the salutary powers of nature being mistaken for the effect of artificial appliances, concurring with the power of imagination, or the magick of a high sounding name: witness tar-water* in this country, and

* I cannot refrain here from transcribing a passage in a letter from Mr. Reeves, to Berkeley, Bishop of Cloyne, entitled

ginseng among the Chinese, animal magnetism, and metallic tractors. On the other hand, there are medicines of great value, which in consequence of being extolled by sanguine credulity, far beyond what experience justifies, come by cool experience, or perhaps inordinate scepticism, to be run down and stripped of all virtue, so that from being proclaimed and applauded, as good for *every thing*, they come to be denounced as good for *nothing*. Cicuta, Digitalis, and Nitric acid, also the cure of cancer by compression, may be quoted as examples of this; and it is in this way we are to account for some valuable medicines having fallen into disuse.

But these delusions are not referable to the credulity and creative imaginations of patients only. Medical authors and practitioners themselves are not exempt from the charge of the like weaknesses; and they have sometimes propounded their doctrines and facts with so much plausibility and unsuspected good faith, as to delude others as well as themselves, who have not been

"A Cure for the Epidemical Madness of Drinking Tar-Water."
"Thus in your younger days, My Lord, you made the surprising discovery of the Non-reality of Matter, and now, in your riper age, you have undertaken to prove the reality of a Universal Remedy: an attempt to talk men out of their reason, did of right belong to that author, who had at first tried to persuade them out of their senses."

sufficiently on their guard. The convictions of their own sanguine minds are, indeed, so irresistible as to betray them into errors against the plainest evidence of their senses. Demosthenes says, ὁ βυλεῖαι τοῦο ἕκαςος και ὁραῖαι, (I quote from memory) or according to the Scotch proverb, *as the fool thinks the bell clinks.* In such cases, the senses, by a sort of complaisance, as it were, conform to the strong pre-conceptions and anxious wishes of their impetuous masters, by representing objects under appearances utterly at variance with the reality of things; and can we view such delusions in any other light than as dilute shades, or faint images as it were, of the phenomena of dreams, mania, apparitions, and somnambulism? Nor can we by any other hypothesis account for Solano's statement of the varieties and indications of the pulse, or for the publication of the effect of remedies, and of cures performed and reported *bona fide* by different authors, which could never be verified by the experience of others.

It is indeed impossible to set bounds to the power of self-delusion in creating sensations excited without the presence or operation of any actual corporeal impresssions. I have frequently seen simple and ignorant persons, when under the false apprehension of having caught a certain impure disorder, tormented with real pains in various parts of their bodies, particularly their loins and

noses. I have been assured by those, who have been in circumstances of exposure to the infection of the plague, and in momentary dread of catching it, that they have felt acute pains in the groins and arm-pits, these being the parts known to be most prominently affected in that epidemick. More familiar, though less aggravated examples of this, occur among those subject to hypochondria. Enthusiasm, mania, dreaming, nightmares, and delirium, give rise to all the diversified forms and gradations, of the same species of delusion.

With regard to that class of delusions which consists in the seeing of apparitions, Dr. Ferriar,* of Manchester, Dr. Alderson, of Hull, and Dr. Hibbert, have very philosophically accounted for them, by proving them to be exemplifications of morbid action, as much as dreams and delirium. There are also some ingenious remarks on the same subject in Mrs. Grant's History of the Popular Superstitions of the Highlands. She mentions that it is part of the creed of those who believe in such delusions as the second sight, that the visions are perceptible to only one person at a time, a circumstance which well accords with the theory of their being morbid affections of a single individual, for were it any thing existing in the

* See Essays, towards a Theory of Apparitions, by these authors, and Medical and Chirurgical Journal of Edinburgh, 1810, p. 287.

reality of external objects, they would be equally perceptible to all.

The greater number of fantastic illusions are of a gloomy colour, and distressful nature: but some being of a cheerful complexion, it becomes a question whether it would be advisable to cure the patient of these. Horace gives his opinion against the dispelling of pleasing illusions in a world in which there is so large a mixture of bitters in the cup of real life, and he illustrates it by the amusing story of a person of this description, who upon being cured of his delightful reveries, exclaims,

"Pol, me occidistis, amici."

Seneca says, *quosdam non nisi deceptos sanari.* And Avicenna, "plus interdum prodesse fiduciam medicinæ quam ipsa medicina." And to the same purpose the English poet,

"If ignorance is bliss, 'tis folly to be wise."

These advantages make some small set-off against the evils of ignorance and delusion.

The value of that recorded knowledge, which rests on testimony, is also greatly impaired, by the difficulty of ascertaining the exact import of the terms, by which the ancients, and even the earlier writers among the moderns, designate the remedies they employed, whether simple or

compound. Of the simples mentioned by the ancients, very few are now recognizable. If we except opium, aloes, and perhaps one or two more, it is doubtful, whether there is a single article of the ancient *materia medica*, which can be satisfactorily identified; and for want of such knowledge, much valuable practical instruction has been lost. This will be best illustrated by an example. A secret medicine, under the title of *Eau Médicinale de Husson*, was introduced into this country, in one of the first years of this century, as a remedy for the gout,* and it was found peculiarly beneficial in a great number of cases, particularly in that of Sir Joseph Banks, President of the Royal Society. A few years afterwards, it was discovered that a vinous tincture of the *colchicum autumnale* had the same virtue, and little doubt was entertained of the identity of this, and the secret medicine; and Sir Joseph Banks, among others, has experienced exactly the same effects from both. About the same time, a passage was noticed in the works of Alexander Trallian, a physician who practised in Asia Minor, in the fourth century, ascribing similar effects to a medicine called hermodactyls. This was naturally supposed to be the same with the colchicum; but as there was no description of

* See a clear exposition of the History and virtues of this medicine, in a work entitled "An Account of the remarkable "Effects of the Eau Médicinale de Husson, on the Gout." By Edwin Godden Jones, M. D. London, 1810.

it in any ancient author, this was merely matter of conjecture, till enquiry having been made at Constantinople, it was discovered, that there was an herb still bearing that name brought from the Islands of the Archipelago, and specimens of it being transmitted to Sir Joseph Banks, it was actually found to be a species of colchicum. Others, as well as he, have used a vinous tincture of the root of this herb with the same good effects as the French nostrum; and to these proofs of the identity of their operation, I can add my own experienee in a great number of cases of articular gout in which I have prescribed it: And I have found that not only the acute fits can be cured by it, but that by a small dose of it, combined with a few drops of tincture, or rather the wine of opium, and as much tincture of rhubarb and magnesia as will regulate the bowels, taken every night at bed-time, the attacks may either be prevented for an indefinite length of time, or so shortened and mitigated, as to give the patient a sort of renewed existence.

Here was a most valuable piece of knowledge, lost to the world for many ages, from the want of a description of the article, which, on that account, could not be recognized from one age and country to another. And we see what incalculable advantage must result to medicine in general, from the cultivation of natural knowledge, from

this consideration, as well as others already stated; an advantage peculiar to the present age, for never till now, have the various objects of natural history, particularly of botany, been so described, that in all ages to come, however remote, no ambiguity can arise, regarding the identity of the remedies recommended, among the medical practitioners of this, or any future age.

From the like consideration, we see a reason for the adoption of the scientific and systematic terms, in the *materia medica* and pharmacopœia, in preference to those loose and trivial names, of which the true import could never be ascertained by our posterity. But, for the like reason, the terms which have been abolished, and which have passed into desuetude, should be kept upon record, with explanations annexed to them; for there are many of the titles of medicines, especially those that are compound, which are already so far forgotten, that much of the practical knowledge, contained in the works of the authors of the 16th, 17th, and even in the beginning of the 18th century, such as Hoffman,* is nearly lost. Their titles are so obscure and quaint, as to convey no knowledge of their ingredients; and it is next to impossible, for a common reader, to find a description of them, to serve as a

* There is a translation into English, of the practical parts of this author, by Dr. Duncan, which, for want of a glossary for the compound medicines, is of little value.

key to the author's meaning. It would add greatly to the value of pharmacopœias, if a glossary to these compositions were annexed to them, in place of studiously avoiding all mention of obsolete terms, as is the custom in these works. A work explanatory of the old formulas of medicine would be extremely useful, and is a *desideratum* in medical literature.

There is still another circumstance deserving of mention, for which due consideration should be had in the writings of the ancients, as it contributes to the uncertainty of the knowledge transmitted to us in their writings: errors of transcriptions are incident to all subjects; but more particularly to those that are professional and technical, because being less understood by transcribers than subjects of general knowledge, substitutions and omissions are more likely to occur.

On this subject of medical testimony, it is necessary to guard against scepticism, as well as credulity. The numerous instances in which boasted remedies, and plans of cure, proposed by practitioners, are found to fail in the hands of others, produce a fastidiousness, which is occasionally carried to excess. It has already been remarked, that from the diversity of constitutions, the same remedies will not universally succeed. If a medicine therefore, newly recommended, on respectable autho-

rity, should not be found to answer to its character, on its first trial, it should not be abandoned. I can exemplify this in myself. About fifty years ago, the volatile tincture of *guaiacum* or *tinctura guaiaci ammoniata*, in doses of half an ounce, was proposed confidently by Dr. Dawson, on his own experience, as a remedy in acute rheumatism, to be administered after the fever had been lowered by the use of some evacuating medicines. My first trials of this practice were so discouraging, that I laid it aside for several years, and the more readily, that it did not seem very consonant to reason, that a medicine, so stimulant, could be adapted to a disease in which there was so much heat, and excitement, and I found the like objection made to it by other practitioners: but on returning to its use, I found that there were cases, in which it succeeded to my utmost wish. It seemed to be best adapted to the habits in which there was scrofula, or a constitution allied to it.

SECTION IX.

THE SEVENTH SOURCE OF ERROR. THE INFLUENCE OF AUTHORITY AND FASHION,

Consists in the Abuse of a laudable Principle.—The Pythagoreans enjoined it.—Its pernicious Influence in the case of Aristotle's Logick and Metaphysicks.—Motto of the Royal Society.—Its pernicious Influence in Physicks exemplified in the Hypothesis of Phlogiston—In Physick, by the prevalence of Boerhaave's Doctrines.—Great Discoverers discourage their Successors—Exemplified in Sir I. Newton.—Authority ought not to be slighted, but respected.—Conclusion.

The causes of error already enumerated more particularly belong to the art and science of Medicine. The influence of authority is more in common with the practices and opinions of other departments of knowledge. It has also, in common with most of the other sins and errors of human life, that it consists in the excess of what is in its own nature laudable and good. We have seen, in a preceding part of this work, what a strong instinctive propensity man has to imitate his fellow

creatures around him, to which, through this wise institution of Nature, he owes some of his most indispensable acquirements. The like principle leads him in early life spontaneously and unconsciously to conform to the example of his parents, instructors, and casual associates, not only in his accents and gestures, but in his manners, actions, and opinions. It is evident, that from this constitution of the mind, are derived not only innumerable practical benefits, but some virtues, such as docility and modesty. But the misfortune is, that habits and opinions thus imbibed, however erroneous or absurd, are apt to become incorrigible and indelible for the rest of life.

One of the ancient sects of philosophy, so far from disclaiming the sanction of authority, made it one of their avowed principles to refer to the *dictum* of their master in all questionable points, as the ultimate appeal and test of truth, without any reference to reason. There could not well be devised a more effectual bar to the progress of knowledge.

But the most eminent example of the devotion to authority, and its pernicious consequences, is the prevalence of the Aristotelian logick and metaphysicks, which for more than a thousand years engrossed the study of the learned in all Christendom, and even for a long time in the most civilized

of those countries which professed Islamism, to the exclusion nearly of all other useful and liberal knowledge.

On the revival of learning, may it not be alleged, that an undue devotion to authority was deemed one of the main obstacles to the progress of useful and scientific knowledge, by the Royal Society, (founded in the year 1662), assuming for their motto, *nullius in verba ?* There is in the history of chemical science, a very prominent example of the power of authority in what was called *Phlogiston.* This was a hypothesis invented by Stahl, a German professor of great genius, which, after maintaining its ground for a hundred years, and meeting with universal adoption by the most profound and ingenious chemists of all nations, was demonstrated about forty years ago to be a mere fiction. The principal argument in favour of this doctrine was founded on the change which combustible substances, particularly metals, underwent by calcination; and one of the practical facts adduced in refutation of it, was a simple statical experiment, from which it clearly appeared that combustion added something to the calx of metals, instead of any thing being added to the metal on its restoration to its reguline state. But with such reluctance did they cling to the old doctrine, that one of the greatest geniuses of that age endeavoured to defend it by another hypothesis, equally gra-

tuitous and still more extravagant, namely, that phlogiston was a principle possessing absolute levity!

In the course of this work there has occurred more than one occasion to illustrate the present subject, particularly in the case of Boerhaave. It is in my own remembrance to have heard of the many consultations that were sent to him from this country in the course of the first thirty-five years of the last century, and there is in his works a detailed account of fifty-three of these, a great part of which were on cases sent from England. We are not informed of the result of any of them, but the prescriptions are such as would now be deemed either injudicious, detrimental, or inert, and consist chiefly of various doses and combinations of the gum-resins. It is remarkable, that there are only three of these in which opium is prescribed, and syrup of poppies in the same number, mostly in inefficient doses. Yet these are remedies, without which we now think the practice of physick could hardly be carried on; and many of the cases in these consultations, were attended with pains and spasms, for which we now-a-days think opium the best and almost only remedy. Such, however, was the popularity of Boerhaave, that when Dr. Cullen first began his medical lectures in the University of Edinburgh, and ventured to question the soundness of Dr. Boerhaave's principles, the first magi-

strate of that city thought it his duty to admonish the Professor not to persist in instilling such heterodox doctrines into the minds of the youth.

Another circumstance unfavourable to the progress of science, resulting from those splendid discoveries, which have shed lustre, even deserved lustre, on venerated names is, that it discourages their successors, who despairing of adding any thing to the existing stock of knowledge, are thrown into a state of indolence and despondency. The dazzling and astounding discoveries of Newton threw the world into a sort of stupor, which paralysed their exertions. This slumber lasted till they seemed to be awakened from it, as it were, at the end of fifty years, by the Thunder and Lightning of Franklin, when proving the identity of these with electricity. Since this splendid discovery, great additions have been made to every branch of science, particularly that of Philosophical Chemistry, to which Mr. Cavendish, and the present President of the Royal Society have so amply contributed. This might be illustrated and exemplified by other incidents in the history of science and the liberal arts.

Before taking leave of this subject, it is right again to advert to the errors which arise from the slighting of authority. It is quite impossible for any single individual, however highly gifted, to

acquire a competent knowledge of any subject, particularly in that which is practical, without being more or less indebted to the previous labours and discoveries of others; and he who disclaims all obligation and dependance on these, is little less culpable by his flippancy, self-conceit, and inordinate love of novelty, than the others by their slavish complaisance.

On the subject of fashion, what can be said on it must be merely a corollary to what has been said on the subject of authority: for what is fashion but a servile adoption of the opinions, and aping of the actions of others, without any reference to reason? It is exemplified in those not belonging to the profession, by their irrational partialities to particular remedies, and their false estimate of the talents of professional men. There are none of the pursuits of life, whether learned or unlearned, in which their practitioners work so much in the dark, as that of physick. We have had occasion to animadvert upon the difficulty of discovering, when and to what degree, recovery is imputable to nature or to art, and whether the result, be it life or death, is most chargeable on the remedy, or the disease; also whether the patient recovers in *virtue* of the remedy, or in *spite* of it. We may now remark, that to the like darkness is, in part imputable, the wrong judgements which the world form of the merits of practitioners in

physick. And when to this is added the wide field which is open to vain pretension, and the various crooked arts aud adventitious recommendations, by which confidence is conciliated, we shall be at no loss to account for the many capricious partialities, prepossessions, and prejudices, with which the practice of physick is infected. But though the present enlightened age cannot be entirely acquitted of these weaknesses, it cannot be doubted that well accomplished, virtuous, and honourable candidates, for professional practice, stand by far the fairest chance in the race of fortune, as well in the substantial and more important success in the relief of sickness and suffering; and at all events, their conscience and self-respect will ever restrain them from swerving from the straight-forward paths of probity, duty, and honour.*

It will here occur to the reader, that I have still omitted that large head of error which is chargeable on those pre-conceived opinions, whether proceeding from a too hasty acquiescence in supposed truths, or from that want of candour, which by a false pride makes the recantation of error to be felt as a degradation.

* It would be out of place here to dilate on this subject, especially as it is so well handled in a tract of Dr. J. Gregory, of Edinburgh, On the Duties of a Physician; and in the Medical Ethicks of Dr. Percival, of Manchester.

I certainly have not formally stated this in the enumeration of the sources of error; but as the great moral which I have attempted to deduce from several of the preceding heads of this treatise, consists in exemplifylng and illustrating this point, it would only be a piece of tautology to run over the same topicks again.

CONCLUSION.

From the picture that has been exhibited, of the innumerable doubts and difficulties which clog the attainment of medicnl knowledge, and embarrass the application of it to practical purposes, the timid, sceptical, and indolent, may be discouraged from studies apparently so arduous in their prosecution, and so questionable as to the efficiency, and utility of their result. But it is not from characters of this description, that any good can be expected in any of the useful arts of life. If a like despondency were to pervade mankind in general, there would be an end to all that enterprize and energy, which alone can enable them to act up to their destiny, and follow up those pursuits, upon which the perfection of their nature depends. As the senses would have lain dormant for ever had there been no external objects to stimulate them, so the faculties and virtues, which characterize rational nature and civilized life, could never have been developed, but through the excitement of those pains, wants, difficulties, and

dangers, inseparable from the actual circumstances and condition of human life. By no other arrangement could our duties, our happiness, our mental and bodily perfections, have been bound together in one harmonious and consistent whole. Let us compare the art of medicine, under this aspect, with those of navigation and agriculture.—Had man been furnished by the Creator with wings, by which he might have traversed all seas and oceans, so as to supersede the use of ships, where would have been that hardihood of character, and all those ingenious devices, which have called forth the active energies and deep researches of the human mind? If, contrary to the actual institutions of Providence, the life of man had been sustained by the spontaneous productions of nature, instead of the products of industry, neither the faculties of the mind, nor the powers of the body, could ever have been developed: man would have been little superior to the brutes: his active and inventive energies would have lain asleep for ever: there would have been no room for the talents exercised in the procuring of food, raiment, and shelter, nor in commercial intercourse: all the mutual and endearing ties, and dependeneies of social and civilized life, all trades, professions, arts, and sciences, whether ministering to accommodation, or elegance, constituting man's greatest felicity, whether as objects of pursuit, or enjoyment, would have been unknown, and untasted.

It is obvious, that this reasoning being founded on a general law of Nature, must apply equally to Medicine. In a probationary existence, it was necessary that man should be tried, not only by pain and sickness, but by the difficulties of remedying them, as exercises of virtue and ingenuity: Why should the road to medical relief lie through fewer and lighter struggles and dangers, than those of navigation and agriculture?—But the subject is more concisely and emphatically elucidated by the philosophical poet, than by any amplitude of illustration, or farther multiplicity of words which I could employ:

——— Pater ipse colendi (*medendi*),
Haud facilem esse viam voluit, primusque per artem,
Movit agros, (*ægros*) curis acuens mortalia corda.

THE END.

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